

Contractors and Engineers Monthly

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PICKS and SHOVELS

By O. E. POTTER

Safety and the Cinema

While the campaign for safety on the highways is being carried on sincerely and conscientiously by the National Safety Council, the American Road Builders' Association, automobile associations, state highway departments, insurance companies, magazines, newspapers, and individuals who have been stirred to action by the appalling number of accidents on the highways, there are still potent factors working at cross purposes which tend to thwart the best efforts of these organizations.

The automobile manufacturers are doing all they can to build safety into the cars of today, the tire manufacturers have eliminated the hazards of driving on old-fashioned tires, the state highway departments are bending every energy to provide well-designed highways offering the minimum of danger to the driving public, as well as providing maintenance, danger signs, grade separations, and adequate visibility. And still the accidents occur.

A Matter of Education

This publication has joined in the chorus shouting the battle cry of safety. We have regularly published articles and news stories on what can be done and is being accomplished in redesigning, planning, maintaining and lighting highways to make them safe for car drivers.

In the May, 1936, issue of this magazine there appeared an editorial entitled "This Safety Business" discussing what has been done by state highway departments and urging the necessity for educating the public, particularly the young people who are to become the

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A Hot-Mix Road On Mountain Top

New Section of U. S. 40 at Idaho Springs, Colo., Built By Hamilton & Gleason of Denver

USING the same plant set-up that furnished the hot mix for a 13.5-mile surfacing contract with the U. S. Forest Service in 1935 on the Echo Lake Road, Hamilton & Gleason paved 2.2 miles of the Denver-Salt Lake City highway west of Idaho Springs, Colo., in the summer of 1936. The contract was very favorable to the state as the overhead of moving a plant into this mountain section would have been very high for such a short project.

Aggregate Production

The aggregate was chiefly from the waste pile of the 1935 contract as the

(Continued on page 39)

A Pair of Pavers Pour Two-Course Road In Western N. Y.

J. M. Murray, Contractor, Used L. C. L. Containers for Aggregates; Had Well-Maintained Equipment

THE construction of a new concrete road over an existing concrete pavement while traffic is being maintained is always a difficult job for a contractor. FAP Repair Contract 3675 in New York State last summer was no exception. It consisted of laying 20 and 30-foot 2-course concrete pavement of 6, 7 and 8-inch thickness, some over and part alongside an old 16-foot concrete pavement. This naturally somewhat slowed up operations, but J. M. Murray of Rochester, N.Y., who was awarded the contract for \$328,491.91, produced 6.81

miles of new widened pavement on N.Y. State Route 17 along the eastern shore of Lake Chataqua with remarkable celerity.

Batching Plant

The contractor purchased slag, sand aggregate and cement in New York Central LCL containers. The siding where the batching plant was located was about at the middle of the concrete paving and consisted of two lines of tracks with the two cranes and two batchers located between the tracks. There were no stockpiles. On the easterly track three slag cars could be spotted and the containers unloaded by a Browning crane with a special handling rig to the Blaw-Knox batcher equipped with Howe scales. The westerly track contained three cars of containers with sand and two with cement. The sand was unloaded by a Speedcrane to the second compartment of the northerly batching plant and the same crane unloaded the cement to the Blaw-Knox cement batching plant equipped with Richardson scales. By unloading cement in this manner, it was necessary to remove the steel cover to the cement bin which was taken off each day and set beside the plant before the crane started loading the bin. There were twelve LCL containers per car, each holding 5 tons.

The small storage on these sidings necessitated frequent switching to deliver loaded cars. When necessary to move empties, the work was done by the cranes.

At the start of the work the batch trucks drove through under the cement batcher and then to the sand and slag batcher. This was later reversed as much cement was lost through the tail gates of the trucks. The set-up was well planned with the trucks driving through both batchers, the only difficulty being the small track storage space available. Hired 2-batch trucks were used for hauling, the number varying from eight to fourteen, depending upon the length of haul.

As this was a 2-course pavement, the batches varied somewhat. For the bottom course which was 4, 5 or 6 inches thick, 23.35 cubic feet of slag, 1,690 pounds of sand, 376 pounds of portland cement and 1.16 bags of natural cement, added for workability, were used per batch. For the uniform 2-inch top the batch consisted of 20.6 cubic feet of slag, 1,720 pounds of sand, 564 pounds of portland cement and two bags of natural cement.

Preparation of Grade

Much of the preparation of the grade

(Continued on page 27)



"The Pause That Refreshes." A Lubrication Crew at Work on a Tractor at Grand Coulee. See Page 18.

Bituminous Patching Reinforced with Burlap Used on Arizona Highways Since 1932

(Photos on page 52)

PRESENT laboratory methods of testing the subsoil before the construction of any kind of pavement have done away with a great deal of the uncertainty as to the future of the pavement. There have been in the past many failures of bituminous surface in Arizona due to the seepage from irrigation ditches softening the clay and other subsoils affected by moisture and becoming unstable.

In 1932 a novel method of repairing these weak spots with burlap reinforcing was developed and has proved effective for periods as long as five years. The patches have lasted uniformly five times as long as those without the burlap reinforcement. Thus we have a method antedating the present experimental use of cotton for the reinforcing and waterproofing of pavements. The material used in Arizona is a burlap made from hemp, a material known for its strength and durability. No. 2

barley sacks, with $9\frac{1}{2}$ square feet of burlap per sack, were used. The cotton has yet to show finally its value as regards strength and life in the road.

When a bad section was found the parts showing breaks caused by moisture were cut out or if large enough to warrant the use of machinery they were scarified and the material in the failed section bladed in a windrow to the side. Beneath this was found invariably a clay or "ecummy" material which was dug out and wasted. Then the good top material was put back into the hole, taking the place of the poor subgrade material that was wasted. This served to stabilize the base.

On top of the newly stabilized base opened gunny sacks were laid and impregnated with an asphalt cut-back made with 65 penetration asphalt. This saturated the sack and without weakening the mechanical strength of the material protected it from rotting due to moisture that might still seep into the subgrade.

(Continued on page 12)

Widening Cape Cod Canal

Dry Excavation, Riprap and Dredging Under Way

Group of Contractors Speed Improvement of Famous Channel, Using Heavy Equipment

(Photos on page 52)

MORE than a dozen contracts have been awarded by the U. S. Engineer Department for the widening of the Cape Cod Canal to facilitate the movement of the increasing coastwise traffic from Long Island Sound through Buzzards Bay into Massachusetts Bay. The original 100-foot canal was widened to 205 feet in 1935 with theoretical slopes of 1:2½ below mean low water and of 1:2 above. The present \$35,000,000 project will provide a 32-foot depth and a 540-foot bottom width. Minor changes in alignment are being made where possible to avoid heavy excavation. The new center line varies from the old so that the dry excavation varies in width from zero to 300 feet.

The project is approximately 15 miles in length of which about 8 miles is land cut and about 7 miles is approach channel in Buzzards Bay. Crawler shovels and draglines are handling the dry excavation while bucket and suction dredges remove the under-water sections.

The Contracts

Land work on the north side of the canal starting at the east, or Massachusetts Bay, end of the canal is as follows:

Stations 10+50 to 70, A. G. Tomasello & Sons, Type A revetment and a relief channel for the Scusset River.

Stations 70 to 150, Merritt, Chapman & Scott Corp., New London, Conn., Type A revetment. The Sagamore Bridge at Station 140 is located within the limits of this contract. During the work in this section a bad peat pocket was struck which extended to 16 feet below low water with an "axle grease" mud layer below the peat. The contractor brought in a derrick boat and clamshell to excavate the material until it became too soupy to handle, then the hole was back-filled with sand which sank through the mud to the sand bottom, the depth of which had been determined previously by wash borings.

Stations 150 to 255, Coleman Bros., Boston, Mass., Type A, Type B and Type C revetment.

Stations 255 to 325, Merritt, Chapman & Scott Corp., Type A revetment.

Stations 325 to 377, B. Perini & Sons, Inc., Framingham, Mass., Type A and Type B revetment. This contractor also

had a short section, Stations 386 to 391, around the U. S. Engineer Department Administration Building between the new lift-span railroad bridge and the State Pier, the work consisting of Type C riprap which is a modified Type A.

A mooring basin at the east end of the canal on the north side near the fish packing plant was excavated by the Atlantic, Gulf & Pacific Co., New York City, with the dredge Florida.

Under-water work at the east end of the canal was done by M. A. Breyman Dredging Co. of New York City with the Toledo III, a steam dredge with oil-fired boilers and equipped with a 15-yard dipper, and three spuds. This dredge loaded to 1,200 to 1,500-cubic yard steel scows handled by one steam



C. & E. M. Photo

Ships Can "Pass in the Night" in the Widened Cape Cod Canal

and one diesel tug, both hired. This outfit worked 24 hours a day, moving an average of 15,000 yards in that period.

The work on the south side of the canal was divided into contracts as follows:

Stations 9 to 18 and 36 to 78, B. Perini & Sons, Inc., Framingham, Mass., Type B revetment where considerable trouble was experienced with a bad clay subsoil and peat that flowed.

Stations 18 to 36, L. E. McLaughlin Co., New Haven, Conn. This work, involving the construction of a new bulkhead at the location of a fish packing plant and Coast Guard station, will be described in a later paragraph.

Stations 78 to 150, Merritt, Chapman & Scott Corp., New London, Conn., Type B revetment.

Stations 150 to 320, B. Perini & Sons, Inc., Framingham, Mass., Type A and Type B revetment. This is the largest contract on the job, involving 2,200,000 cubic yards of dry excavation with 23,000 cubic yards of boulders. The details of this work are described later in this article.

Stations 320 to 371, Cenedella & Co., Milford, Mass., Type A and Type B revetment, involving tough digging and the removal of small boulders from 1 cubic foot in size cemented with larger boulders under 10 feet of fine sand.

Stations 371 to 387+50, Dennis F. Crowley, Quincy, Mass., Type A and Type B revetment.

Riprap, Types A and B

Type A and Type B riprap are different. (Continued on page 14)



C. & E. M. Photo

The Three-Span Bridge Completed

Grading in Dust,— Attractive Bridges

Porter McCully Const. Co. Built 3 and 5-Span Bridges While F. C. Feutz Piled Up Grade in Desert Dryness

AN elevating grader pouring forth clouds of dust with trucks disappearing in the constant haze and truck drivers all looking like Al Jolson in black-face set the picture for the F. C. Feutz grading contract between Heyworth and McLean, Ill., last summer. The constant lack of rain and the temperatures above 100 for over two weeks in July made completion of the final grade practically impossible. Illinois specifications require that all fills be laid down in 6-inch layers loose measurement and sprinkled to give maximum compaction and density under the Proctor test, but who can lay down dust in the absence of water and get more than an approximation of final grade?

Grading

Work on this 10-mile contract was started March 31, 1936, with a 42-inch Austin-Western power elevating grader pulled by a Caterpillar Sixty-Five working from about the center of the project toward the west end. A fleet of 10 to 20 hired light trucks worked under the grader and hauled the material to the long shallow fill sections. There were no borrow pits on the entire contract and the maximum cut on the contract was 32,000 cubic yards in ½ mile.

When the first grading outfit had completed about 2 miles it was returned to the start and began working east toward Heyworth. A second outfit was started about May 1 where the first stopped and continued west to the end of the contract at McLean. It was composed of a Caterpillar 42-inch elevating grader with a power-driven belt pulled by a Caterpillar Sixty-Five. It loaded to a fleet of six contractor-owned 7-yard Streich dump wagons pulled with Sixty-Five tractors. The dust during June and July was from 4 to 8 inches deep and hampered the work greatly.

The two sections of the contract had a total of 125,000 cubic yards of earth excavation, all of which was handled by the two elevating graders. The ma-

(Continued on page 28)

Cost of Oil Treatment On County Highways

Dust and Frost Boils Eliminated by Program Involving Purchase of New Oil Distributor

By WILLIAM GREEN

Douglas County, Nebraska, Surveyor and Highway Commissioner

(Photo on page 52)

DOUGLAS County's maintenance bill has reached a level which has made imperative the development of a program that will stretch present available funds to meet the constantly increasing demands of Nebraska's metropolitan area, the center of which is Omaha.

In 1933, auto license fees, which provide maintenance funds, were reduced by legislative action to 55 per cent of those realized during the several preceding years, and have since shown no increase.

As in other counties of the country, we are confronted with the inescapable charges for plant and equipment, dragging, drainage, snow removal, storm damage, surface replacement and repair which must be provided to insure uninterrupted highway service. It is also most essential that an economical method of reducing constant erosion of shoulders along paved surfaces be provided.

Exclusive of the state system of 138 miles, 54 per cent of our highway mileage is gravel surfaced, 35 per cent earth and 11 per cent paved. Upon completion of regravelling and new gravel projects now being or to be constructed with the assistance of WPA, we shall have 327 miles, or 65 per cent of our county system, of gravel surfaced highway. Of this 327 miles, 65 per cent are rural mail routes, and the greater portion of them may be considered farm-to-market roads.

Oil Treatment Recommended

I am convinced that dragging, surface replacement and repair charges on our graveled roads can be cut to a minimum, and comfort and safety of travel greatly enhanced by an economical oil treatment, such treatment to be adapted to subsoil conditions, and the character and volume of traffic.

Widespread demand for more substantial surfaces than it has been heretofore possible to provide for heavily-traveled streets and avenues in suburban additions has become too insistent to ignore. Those maintenance officials who are confronted with numberless appeals for "cinders to help us out of the mud" know the cost as well as the temporary nature of that kind of surfacing.

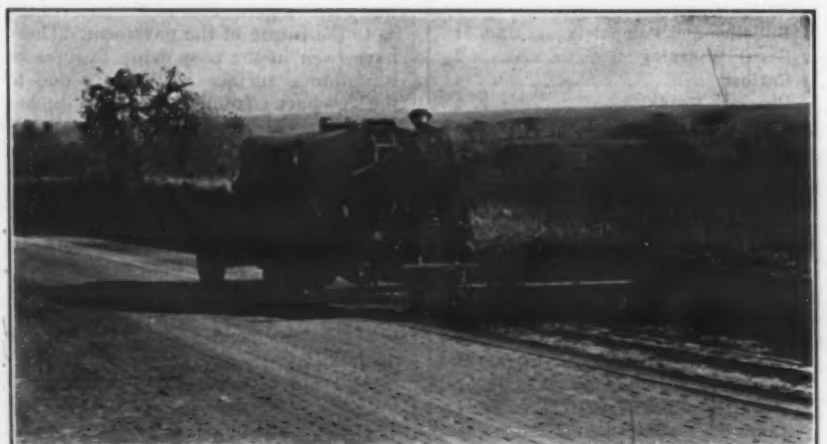
There is no doubt that for suburban streets and secondary highways, an oil-sealed surface of low cost can be provided which will more than justify the initial expense.

(Continued on page 26)



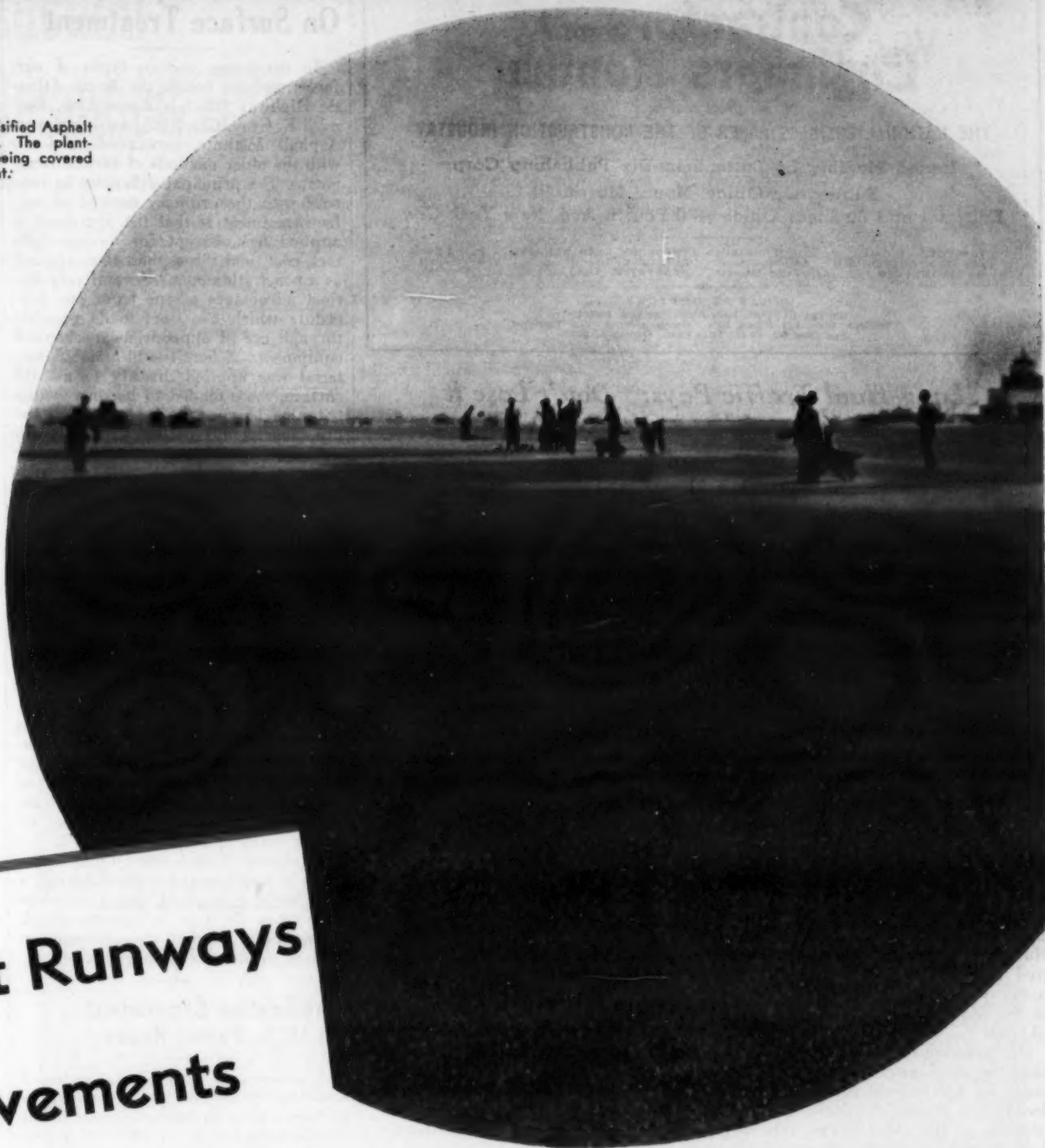
C. & E. M. Photo

Using a Stone Skip to Place Heavy Riprap



Shoulder Oiling Along a Brick Pavement in Douglas County, Nebraska

Runway construction with Texaco Emulsified Asphalt at Allegheny County, Pa., Airport. The plant-mixed Emulsion wearing surface is being covered with grit prior to Emulsion seal coat.



In Airport Runways as in Pavements

resilience means longer life

When a descending airplane strikes a resilient asphalt runway, the impact is cushioned. Runway and plane, as a result, experience less shock, serve longer and require less upkeep. Resilient street and highway surfaces possess the same important advantages as resilient airport runways. TEXACO Asphalt pavements of all types stand up for so many years with such negligible maintenance, largely because they react to heavy traffic impact by absorbing it.



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Long-Haul Traffic Pays: Don't Lose It Because of Your Old Roads

More money went into more miles of state highway construction in 1936 than in 1935, according to recent reports from state highway departments. Because of the era of general spending on which we seem to be embarking, the revenues from gasoline taxes, vehicle licenses and other sources upon which state highway departments are dependent for their road money will be greater, so that we can look forward with assurance to funds for further increases in improved secondary mileage, the feeder roads, and vast improvements in the main highway system.

Some of our older main routes, bearing such noble names as Lincoln and Roosevelt, the First, are greatly in need of reconstruction. The surfacing was the best known 20 years ago, on bases that were thought adequate, and were adequate for the traffic of that day, but the weathering and the pounding of increasingly faster and heavier vehicles has shattered the illusion of permanence. Much of these highways has been covered with retread which unfortunately is too quickly kneaded into the cracks of the old pavement below and soon takes on its contour.

Our program for the future must continue the development of the secondary roads, so well started in the past half decade, but it must also include further attention to the older routes, repaving them as wider and safer thoroughfares,

to match the pace of the traffic of the future.

Who uses these interstate transcontinental highways? There are three types of users: long-distance heavy trucks, long-distance business travelers in passenger cars, and tourists. The latter includes the traveler who sleeps and eats in hotels, the traveler who uses cabins and tourist homes, and that ever-increasing genus "the tin-can tourist" who today approaches regal estate in a trailer palace.

Each of these classes distributes money in many states, making a direct contribution to state highway funds through the gasoline tax, as well as indirect contributions through payments for the immediate needs of the driver and passengers. Each travels chiefly on the main roads when they are smooth, but the touring bureaus of the AAA, the dispensers of fuel at gas stations, and the "grapevine" quickly pass along the word "Drive through the next state south, or north. This state's through roads are getting rough. They were built a long time ago."

It would surprise some state highway departments and businesses dependent on motor travel to know the tremendous influence of the travel bureaus in directing automobile traffic and its attendant expenditures into or away from a state by re-routing because of poor surfaces on the main roads.

Hats Off to "The Bureau"!

Variouly referred to as "The Bureau" or "B.P.R.," the U. S. Bureau of Public Roads of the Department of Agriculture has been the most potent influence for stability and wisdom in highway construction in this country. Rather than being a too autocratic governmental agency, it has fostered the best in administration and the best in construction through the judicious control of the flow of Federal-Aid highway funds from Uncle Sam's purse.

In its 20 years of administering Federal-Aid, the Bureau has supervised the expenditure of \$1,500,000,000 on state highways, matched by an equal sum furnished by the states, but all expended under the watchful eyes of Federal, as well as state, inspectors as a check against too great state political influence in the operation of any job.

During the life of the highway program to end unemployment administered by the B.P.R., up to June 30, 1936, a

total of 38,220 miles of road was constructed at a cost of \$636,622,561, of which \$571,276,033 was paid by the Federal Government. The mileage completed in the year ending June 30, 1936, amounted to 13,789.

Under the emergency grade-crossing program, projects approved or under construction included 1,407 new crossing eliminations, the reconstruction of 198 existing structures, and the protection without elimination of 322 crossings, at a total cost of \$133,524,019, of which the Federal share was \$130,681,697.

The Bureau also supervises road construction in Federal areas and during the fiscal year 1936 completed 436 miles in public lands, 235 miles of national forest road, and 203 miles of road in national parks and monuments.

Hats off to the Bureau for its excellent record of diplomacy, firm administration and results!

Road Work in Ecuador

Construction activity in Ecuador during the first half of 1936 was greater than during any period since 1930, according to a report from the U. S. Bureau of Foreign and Domestic Commerce, but there was a distinct decrease in activity at the middle of the year,

owing to stringent economic conditions. Approximately \$375,000 was allotted in the 1936 budget for the construction and maintenance of highways. Most of the work being done is not of a permanent nature, but consists of cutting dirt roads through the less populated regions and the building of small bridges and culverts.

Road-Mix Improvement On Surface Treatment

In discussing various types of surface treatment before the North Atlantic Highway Officials Association, Bernard E. Gray, Chief Highway Engineer, Asphalt Institute, contrasted road-mix with the older methods of surface treatment. The principal difference in contrast with the ordinary method of surface treatment is that the aggregate is applied first, except for a very light tack coat, and the asphalt then applied as a penetration coat. Several very distinct advantages accrue from this procedure which has been made possible through use of appropriate mechanical equipment. Where the bituminous material was applied directly to an old surface, there tended to be uneven distribution because the various small depressions would collect asphalt from the adjacent higher areas. When cover then was applied in a uniform distribution, there resulted a non-uniform coating, and often a variable surface appearance with alternate fat and lean spots.

With the aggregate placed first at a uniform rate per square yard, followed by the application of the asphalt, also at a uniform rate per square yard, there is a uniform relation between aggregate and asphalt, so that when the two are mixed with appropriate blade machines, even though under the screed the mixture may be spread at variable depths, the surface texture is the same throughout, and there is a complete blending of the surface, looking more like a new pavement than the old-fashioned surface treatment. A final seal coat of a very small amount, using an aggregate between $\frac{3}{8}$ -inch and 10 mesh, produces a fine grained texture having a completely waterproof character while underneath the mix is coarse grained, having high internal strength and resistance to movement under traffic.

Stabilization Experiment On U. S. Forest Roads

A network of over 70,000 miles of woodland roads throughout our national forests play an important part in the fire protection work of the U. S. Forest Service. The very light traffic justifies only a low-cost soil-type road but the economic value of the forests necessitates that the roads be kept passable at all times.

Most of the roads now in use are of the sand-clay or gravel-sand-clay types. Too often these roads are practically impassable in the wet seasons and even in dry weather, rapid disintegration of the surface makes them unsatisfactory for traffic.

In a search for a cheap but serviceable road, the Forest Service has been conducting a series of experiments with soil road stabilization on the Cherokee National Forest, near Gainesville, Ga. The experiment includes scientifically selected and graded sand-clay and gravel-sand-clay surfacing, with and without chemical admixtures. Test sections were constructed in the fall of 1935.

The effect of calcium chloride used as an admixture in preserving the stability of the road surface was very evident eight months later, in the spring. The untreated sections were becoming dusty and rough and there was evidence of appreciable material loss. The chemically treated sections, on the contrary, were smooth and dustless and contained no loose material. The calcium-chloride-stabilized surfaces were found to be impervious to rains and rutting, and their resistance to disintegration effects considerable savings in upkeep.

Stabilized soil roads are now being constructed by the Forest Service at a number of other locations.



By Bob McKnight

"I Got to Thinkin' About a Roller Coaster and All of a Sudden There She Was!"

What of Our Roads?

The net result of road planning and building to date has produced something in the vicinity of 3,000,000 miles of road in the United States, ranging from the barely passable dirt trail to the broad surfaced, multi-lane highway in the vicinity of population centers. Traffic ranges on this mileage from zero vehicles per day to in excess of 60,000 vehicles a day, passing a given point 365 days a year. These 3,000,000 miles of road are under the jurisdiction of Federal, state, county and local township governments. Add to this mileage the local and arterial streets in the cities of the country, and we then have the complete physical plant with which the traffic engineer and the highway engineer have to deal.

The physical condition of the highway systems in the United States is glimpsed from the following: 160,000 miles of the 325,000 miles of primary system are paved; 975,000 miles of the 3,000,000 miles total have surfacing of which 967,000 miles are two-lane highway, and 8,000 miles are hard surface, multiple lane; 2,000,000 miles of road have little or no improvement.

Fred C. Taylor, Director, Highway Planning Survey, Michigan State Highway Department, in a paper presented before the National Safety Congress in October, called attention to the fact that even though these figures are only approximate, they give some notion of the highway job yet to be done, and with which the highway and traffic engineers must cope immediately because of the accumulated lag between road building and the now evident need of the modern motor car.

Tennessee Highway Officials Oppose Motor Tax Diversion

The Tennessee County Highway Association, whose membership includes highway officials of more than half of the counties, has gone on record as opposing the diversion of gasoline and other automotive tax funds for non-highway purposes.

Of the \$18,500,000 collected last year from gasoline taxes, motor registration fees and similar items, \$2,654,785, or 14.4 per cent, was diverted to other than highway uses.

Tennessee has a gasoline tax of 7 cents a gallon, one of the highest in the country.

The Italian Minister of Public Works, visiting Ethiopia last October, signed contracts with Italian firms for the construction of a highway from the port of Assab, Eritrea, via Sardo to Dessie and Addis Ababa, according to a report from the U. S. Bureau of Foreign and Domestic Commerce. Two stipulations of the contract are that the road must be practicable, even in the rainy season, by June 30, 1937, and it must be entirely completed by June, 1938.

Aggregate Production In Well-Designed Plant

**Radcliff & Berry Operated
Quarry for L. P. Cavett Co.
Crushing Road-Mix Stone
South of Hanover, Ind.**

(Photos on page 52)

ALL of us have seen crushing and screening plants hastily thrown together on the job, with only "prayers and haywire" to keep them from falling apart. This is not that kind of a story, but the description of a plant carefully designed, erected and operated by men who have had seventeen years of experience in setting up plants and having them come through the job without breakdowns and just as solid and free of vibration as the day erection was completed.

It was necessary to produce 35,000 tons of stone for the 7.633 miles of road-mix surface which L. P. Cavett Co. of Lockland, Ohio, contracted to build on Indiana Route 62 south of Hanover. In order to insure constant production, the contractor arranged to have Radcliff & Berry of Hardinsburg, Ind., operate the quarry.

Every board of the bins was just as level and straight as the shafts for the main drive, the engine, compressor and the jackshaft that drove the reduction crusher. Every bit of that plant could have continued in operation for years with ordinary maintenance, but it was only erected to furnish the aggregate for one road contract.

A Shallow Quarry

The quarry was located about one-quarter mile south of the north end of the job and was about 300 x 100 feet in area and 16 feet deep, operating in two lifts 8 feet each. The average overburden was about 4 feet deep and was removed from the limestone outcrop with a scraper. The final cleaning up of the earth cover was done by hand labor and the entire surface of the quarry laid bare before operations were started in removing the stone.

Air at 100 pounds pressure was furnished by a Davey 210-foot compressor operated by a V-belt drive from a secondary pulley of the diesel engine that ran the crushing and screening plant. Air was piped to the quarry through a 2-inch pipe which was reduced to 3/4-inch for the last 50 feet before the air hose was attached. The drilling was done entirely with I-R jack hammers using maximum 8-foot steel with Timken detachable bits. These were sharpened on the job by grinding them with an emery wheel.

The contractor spotted four Lambert 1 1/2-yard quarry skips around the quarry with a crew of three men to load each skip. A Ford V-8 truck without a body but with a special frame at the rear mounting a Wood hydraulic hoist, and with a counterbalance on the front bumper hauled the skips from the quarry to the feeding hopper, making the round trip haul in about 2 minutes. The skips were attached to the truck by hooks and the hoist lifted them clear of the ground. At the crusher the feeder dumped the skips as the driver slacked off the chains operated by the hydraulic hoist on the truck.

The quarry was protected from flooding by two drainage ditches, the first an existing channel which was bridged for

the truck to cross from the quarry to the crusher; the other on the opposite side of the quarry was dug by the contractor. The ramp leading to the bridge and the second ramp to the feeding hopper were covered with crushed stone.

Power Plant

Diesel power was furnished for the operation of the plant by a Caterpillar D-13,000 130-hp unit mounted on 12 x 14-inch sleepers 9 feet long. The engine and the compressor unit, mounted on its air tank, were carried on a frame of channels cross-braced with I beams and with the sleepers beneath. Under the compressor were 7 x 9-inch ties all care-



C. & E. M. Photo

The Power Plant and Compressor Hook-Up

fully leveled to insure smooth operation with all bearings horizontal. The diesel engine drove the crusher by belt and the bucket elevator was also driven by the same belt. A 7-strand V belt drove the compressor from a pulley at the same end of the engine shaft as the main belt pulley. At the radiator end of the en-

gine shaft another 5-strand V belt drove a Jas. Clark, Jr., Electric Co. 7.5-kw generator which furnished power for seven 500-watt floodlights when needed and also for the operation of a 5-hp Clark motor which drove the vibrator unit of the double-deck screens.

(Continued on page 40)



The Fastest 3/4 Yard Shovel Ever Offered!

SPEED—Speed for high output has been the keynote in designing this new Northwest Model 25—3/4 yd. shovel.

Fast dipper action, fast swing, simple, easy, responsive control through the well known Northwest "feather-touch" control, power and stability above the ordinary shovel of this capacity, mobility, short tail swing—all combine to increase output beyond the usual expectation for this class and size of machine.

Ball and roller bearings on all high speed shafts assure the full delivery of maximum engine power, and through the Northwest Cushion Clutch, stresses on all parts under power are reduced when the hoist rope is tensioned, permitting the delivery of its great power yet giving it the cushion of steam.

The Northwest welded boom and welded dipper sticks (no Northwest welded boom has ever failed), combined with the Northwest Independent Crowd which utilizes power other shovels waste, assures the most powerful front end on any 3/4 yd. machine.

Bases are cast steel, far superior to the usual fabricated and welded design. Crawlers are of Northwest self-cleaning, time tested design—built especially for shovel, crane, and dragline service.

Cone type swinging clutches give smooth and fast action—and, being fully convertible from shovel to crane or dragline, the Model 25 gives you a machine for every job.

GASOLINE • DIESEL • ELECTRIC
Priced Right. Be sure to investigate before you buy!

NORTHWEST ENGINEERING COMPANY

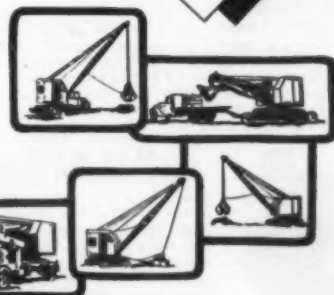
The world's largest exclusive builders
of gasoline, oil, diesel or electric
powered shovels, cranes, draglines,
pullshovels and skimmers

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ELECTRIC
DIESEL
OIL

Built
in a range
of 15 SIZES
3/4 yd. capacity
and
Larger



NORTHWEST



Phantom View of the New Hauck Speed-Master Asphalt Heating Kettle

A New Heating Method In Bituminous Kettles

An entirely new type of tar and asphalt melting kettle known as the Speed-Master has been developed by the Hauck Mfg. Co., 126-134 Tenth St., Brooklyn, N.Y. The manufacturer claims the development of an entirely new heating principle by which the conventional fire-box with its heat losses and kettle-bottom burnouts is eliminated.

In the Speed-Master the heat from the burner is distributed by a double return-tube heating system inside the kettle completely surrounded by asphalt or pitch. The heat is transferred rapidly and uniformly to the material, resulting in fast melting and the cutting of fuel consumption from 50 to 60 per cent because practically all of the heat generated is absorbed by the material.

The kettle is equipped with a no-freeze draw-off cock which prevents cold material solidifying in the cock and eliminating the delays usually experienced when drawing off melted material in the morning. Hauck states that this kettle melts 14 drums of high-melting-point asphalt, or 25 barrels of pitch, in a 75-gallon unit per 10-hour day.

Collection of sediment and slag does not decrease or interfere with the melting speed because the kettle is not heated from the bottom. Sediment is readily

removed when cleaning the kettle and there is an absence of coking which eliminates the need of chopping coked material out of the bottom of the kettle. Other advantages claimed are that the sides, bottom and draw-off end of the Speed-Master are effectively insulated and the entire heating system can be easily removed if and when necessary. This kettle is built in 25, 50, 75 and 100-gallon capacities, is of all-steel construction and furnished in either skid or wheel types, with a detachable fuel tank and burner which can be used as a separate torch heating unit.

Catalog Sheet No. 654 illustrates and describes these kettles and may be secured direct from the Hauck Mfg. Co. by readers of CONTRACTORS AND ENGINEERS MONTHLY.

Missouri is the only one of the 48 states which has maintained the rate of gasoline sales tax which was originally adopted, according to a report of the American Petroleum Institute.



The New Streamlined Cletrac

Crawler Tractors Now Streamlined

The crawler tractor is the latest piece of heavy construction equipment to go streamlined. The Cleveland Tractor Co., Cleveland, Ohio, has announced that Cletrac crawler tractors will henceforth be built for endurance plus eye appeal rather than for endurance and utility alone. The new streamlined design of these crawler tractors eliminates sharp

corners and projections and establishes a new style class.

The Cletrac line of crawler tractors from 22 to 94 drawbar horsepower, powered with internal combustion and diesel engines, have such Cletrac features as controlled differential steering, one-piece drop-forged shoes, track support, lubrication design and frame construction.

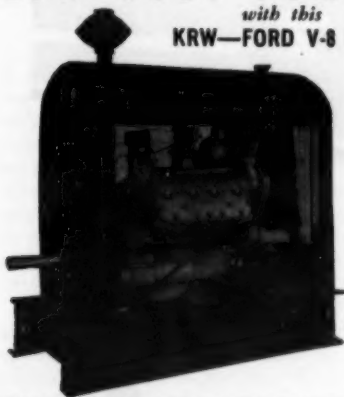
John T. Brown Elected Vice Pres. of Chain Belt

John T. Brown, former Works Manager of Chain Belt Co., Milwaukee, Wis., has been elected a Vice President of the company. Since his graduation from Yale in 1925 he has been associated with the Chain Belt Co., starting as graduate student apprentice, later to become Production Manager and then Works Manager.

The Chain Belt Co. manufactures Rex chain, conveyors, construction machinery and sanitation equipment.

LOW COST POWER

with this
KRW—FORD V-8 UNIT



Here's dependable, low cost power up to 60 H. P.—complete, compact, portable. Ideal for welders, compressors, hoists, pumps, amusement devices, well drillers, agricultural and contractors' equipment, etc. For complete information, prices and data showing how a KRW Unit will pay for itself out of savings in a few weeks, write us or see your local Ford Dealer.



ALSO KRW ELECTRIC PLANTS

Produce your own electric power at a fraction of present cost. Eliminate peak load and stand-by charges. The most complete plant ever devised—both 110 and 220 volts at same time—every protective device—20,000 watts. Runs on gasoline or natural gas.

K. R. WILSON, 21 Lock St., Buffalo, N.Y.
EXCLUSIVE BUILDERS OF APPROVED FORD SHOP EQUIPMENT SINCE 1916

BUILT TO GIVE



Saves Time IN TIGHT PLACES



When digging a cut or widening a narrow road, the Dodge may be run close against the bank. Only an 8 foot tread is required. An additional 5 feet for loading of trucks within the bank width 13 feet.



With a full revolving full track shovel 7 to 8 feet of clearance. 135 H.P. engine is essential to allow for full turning in bank at 22 to 25 feet. Trucks spaced inside the shovel require an additional 5 feet.

Road Patching Speeded By Vibration Method

After considerable experimentation and study, the Indiana State Highway Commission leased a vibrator and screed from the International Vibration Co., Cleveland, Ohio, and applied its method, on which patents are pending, for speeding up the completion of concrete road patching.

The method is simple and direct. The old concrete is broken up and about 75 per cent of it salvaged and left in place for use as aggregate for the base. To insure a firm foundation, this broken concrete is vibrated into place. To this a stiff sand-cement-water grout is added and vibrated down into the old broken concrete. Following the completion of the base course, a surface course of small stone or slag is vibrated into the grout, with the same machine used for vibrating the grout into the broken concrete. As this is completed, a vibrating finisher is drawn across the patch, leav-



Vibrating the Stiff Grout Down Into the Old Broken Concrete

ing a smooth dense surface. The density of the concrete is demonstrated by the fact that it is possible to resume traffic over such a patch three hours after its completion.

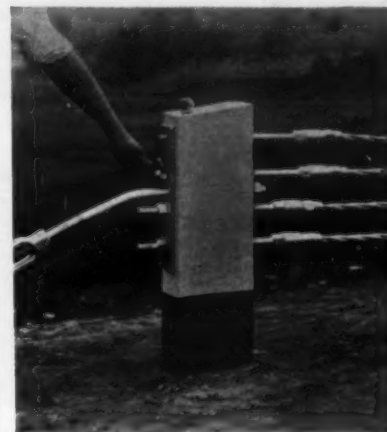
State highway engineers have noted the success of the patches made in this manner and have received much favorable comment from the traveling public

because of the short time the patch section is closed to traffic. In Indiana these patches were made with high-strength cement though this is not considered essential. Other installations have been made using calcium chloride as an accelerator.

Anti-Freeze for Air Lines

Sullivan Machinery Co., Michigan City, Ind., has announced an improvement in the Tanner Tank air line anti-freeze system which eliminates air line and air tool freezing. This system is harmless, odorless and non-explosive and will not injure metal, hose or lubrication. Tanner tanks are built to A.S.M.E. specifications for welded construction for 200 pounds working pressure and are easily installed.

The manufacturer will be pleased to send users of pneumatic equipment a special bulletin on this system guaranteed to work at temperatures down to 70 degrees below zero.



Multisafety Guard Rail Cable Is Easily Tightened by Turning the Nut on the Take-Up Bolts at the Anchor Posts

Protective Guard Rail

The need for protective railing at danger spots on highways was felt as soon as the trails of the pioneers developed into roads for wheeled vehicles. Soon after self-propelled machines became practical, further safeguards became necessary. And the need for even greater protection has arisen now that the speed of travel in motor vehicles is limited only by the self-restraint of the driver.

Multisafety cable highway guard, made by the American Steel & Wire Co., a subsidiary of U. S. Steel Corp., 208 So. LaSalle St., Chicago, Ill., was developed and tried out at the company's proving grounds at Worcester, Mass., where it was exposed to actual conditions comparable to installations on the highway.

This Multisafety highway guard rail consists of wire cable, made of many steel wires wound in helical form into a strand and then several of these strands further wound to form the complete cable, strung through special post brackets mounted on the posts. The feature of the installation is the design of the resilient offset post brackets with slots provided through which from three to nine cables are passed. This holds the cable away from the post, with the result that a car striking the cable is deflected away from the guard rail and is not likely to come into contact with the post, to break it off. If a collision does occur at a post and the impact is so severe that some part of the car strikes the post, the post and its connecting bracket are not locked to the cables, but are free to slide and can be pushed along the cables as a unit without abruptly stopping and therefore greatly damaging the vehicle.

As the cables are held in spaced relation at each post by the slots provided in the post bracket, the cables are prevented from spreading, even though the post is damaged by the force of the impact. The cables are held in the slots provided in the bracket by a stay pin which can readily be installed or removed simply by inserting a pointed tool and prying open the overlapping ends of the post bracket.

The post bracket is provided either with a single hole at the back for attachment to the post, or with two slotted holes permitting the bracket to be tilted, to accommodate changes in vertical gradient.

Multisafety guard does not require exact post spacing. If rocks or other obstructions are encountered when excavating holes for the posts, the holes may be relocated to one side or the other without incurring any difficulty in erection. This latitude in post spacing permits posts to be spaced closer together on curves and widely spaced on tangents. Special tightening bolts for each cable at the ends take up any slack after erection is completed. Malleable iron fittings are used throughout.

More Swings per Hour.. ..MOVE MORE YARDS PER DAY

As compact and nimble as a sub-chaser—as rugged and powerful as a dreadnaught—the half-yard Badger was designed with a single object in view . . . *faster output.*

There is no swinging counter-weight to slow down the starting and stopping operations. No cab to limit visibility of operator. Low center of gravity holds the Badger steady. Boom dipper and dipper stick of light alloy steel, internal expanding clutch drums with extra wearing surface, and 41 anti-friction bearings combine to hold down operating and maintenance cost. *The net result is a faster starting, faster swinging, faster stopping, faster digging unit* that cuts digging time and costs amazingly.

Get the full story of the Badger's outperforming characteristics . . . Its unusual stability . . . Its extra dumping height and reach . . . Its speedy portability to new jobs at truck speeds . . . Its convertibility for crane, drag line, trench hoe, or pile driver. Mail coupon.

THE AUSTIN-WESTERN ROAD MACHINERY CO.
AURORA, ILLINOIS

Austin-Western

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 Tell me more about the
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☐ Bituminous Distributors
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 Address.....
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The New Allis-Chalmers S-O Diesel-Fuel Tractor

New Intermediate Tractor With Diesel-Fuel Power

Allis-Chalmers Mfg. Co., Tractor Division, Milwaukee, Wis., has developed a new Model S-O controlled-ignition tractor between the 49-hp Model K-O and the 79-hp Model L-O tractor. The S-O was developed to fill a need expressed by contractors and highway departments. Allis-Chalmers emphasizes the point that this tractor is an entirely new design in every detail and is in no sense a stepped-up version of other A-C models.

A new four-cylinder controlled-ignition diesel-fuel engine is used in this model. The controlled-ignition principle has been used in Allis-Chalmers diesel-fuel tractors for several years and the advantages claimed for it are the elimination of excessive weight and destructive vibration and insured complete combustion of the fuel with undelayed timing under all operating conditions, which prevents power-wasting pre-ignition.

Other features include a six-speed transmission with a truck-type gear shift which permits changing of gears without stopping the tractor. This new feature materially reduces non-productive operating time. The truck frames are completely equipped with anti-friction bearings and roller bearings are used in all truck rollers and front idlers. The ground pressure is reduced and stability and traction increased through the use of wide track shoes included as standard equipment. The S-O weighs 18,000 pounds and tests have shown its suitability for bulldozing, and hauling 8-yard scrapers, 10 and 12-foot graders and 8 to 12-yard wagons.

Ohio Opens Its Second "Safety Highway"

Dedicated to a new accident-free era in Ohio by state officials and safety authorities, a 1½-mile stretch of "safety educational highway," featuring high-visibility lighting and attention-compelling roadside safety signs, was placed in operation on the Dixie Highway, Route 25, south of Dayton, in November. The Dixie Highway has long been one of the heaviest-traveled transcontinental routes in the state, carrying many heavy trucks and trailers, and has had a bad accident record.

Excellent seeing conditions for the motorist and pedestrian are provided by sixty-six new high-visibility 4,000-lumen G-E luminaires, attached to mast arms mounted 25 feet high and extending 4 feet over the roadway. The poles are spaced 125 feet apart.

Similar to the first of Ohio's safety highways, north of Canton, this road has in addition the roadside safety signs admonishing the motorist to check his brakes regularly, depress his headlight beams when meeting other cars, and keep to the right side of the road. To aid him in carrying out these warnings, white lines are being painted in the center of the road. Road shoulders, intersections and railroad crossings are

also marked.

Safety leaders of the state feel that in their program to bring Ohio from forty-first to first position in highway safety in the United States they have acted logically in starting the crusade

on the main rural highways, for it is there that the most shocking number of fatalities occur, more than half of them taking place at night, despite the reduced volume of traffic.

New All-Wheel-Drive Unit For Light Service

A new all-wheel-drive unit, consisting of the Ford V-8 passenger, light delivery or commercial car chassis of 112-inch wheelbase into which are engineered and built Marmon-Herrington all-wheel-drive units, has been announced by the Marmon-Herrington Co., Inc., Indianapolis, Ind.

These units, which are of interest to state and county highway departments for the use of survey parties, transportation of men and materials from one section of the highway system to the other, or to pull light trailer equipment, as well as to contractors, have the usual Marmon-Herrington all-wheel-drive features such as the driving front

axle, four-speed transmission, transfer case, and semi-elliptic front springs.

The added traction and safety afforded by the driving front axle make possible operation over difficult terrain and for off-the-road work ordinarily assigned to larger, heavier trucks.

Model LD1-4x4, which was shown for the first time at the Newark Motor Truck Show in November, has a permissible gross load of 4,500 pounds, with 7.50 x 15 tires.

**GRIFFIN
WELLPOINT
SYSTEMS**

Keep Your Wet Jobs Ahead of Schedules
The choice of Contractors who investigate
efficiency and cost
Job layouts and estimates furnished
Send for Catalog A

GRIFFIN WELLPOINT CORP.
60 East 42nd Street, New York, N. Y.
Phone Murray Hill 2-2238

"Look what the
*winners** Used!"



GREYHOUND used Texaco. So did Motor Transit, San Antonio, and Oshkosh.*

You can make maintenance records, too—in your own trucks—with this New Texaco Motor Oil.

You will use less oil . . . get lower fuel consumption . . . because . . .

Made by the New Texaco Furfural Process it is cleansed of all harmful gum, sludge, and carbon forming elements.

More bus-miles are lubricated with Texaco Products than with any other brand. The same economies are possible in your trucking equipment, too.

A Texaco representative will be glad to provide practical engineering service to

prove the economies of Texaco Products.

THE TEXAS COMPANY

135 East 42nd Street • New York City
Nation-wide distribution facilities assure prompt delivery

*The 1936 Bus Maintenance Award Winners

Each year the publication Bus Transportation awards gold, silver and bronze medals to the Bus Operators who have made the greatest reduction in their maintenance costs. In 1936 the winners were:

GOLD—Greyhound Management Co.,
Cleveland, O.
GOLD—Motor Transit Co., Jacksonville, Fla.
SILVER—De Camp Bus Lines, Livingston, N. J.
SILVER—San Antonio Public Service Co.,
San Antonio, Texas
BRONZE—Oshkosh City Lines, Inc., Oshkosh, Wis.



**NEW
TEXACO MOTOR OIL**

"Thar's Gold In Them Thar Hills"

(Photo on page 52)

VISIONS of new wealth, or memories of past placer mining operations near Weaverville, Calif., are called forth by the vast grading project now under way 4 miles west of Weaverville where a valley-to-coast highway of increasing importance is being improved. A glacial deposit of gold-bearing sand and gravel creates a mountain over which the old county highway, now Calif.-U.S. 299, climbs in a series of writhing curves. The government San Francisco mint records show that \$7,000,000 in gold has already been taken out of this hill, but the gold specks petered out, except in the direction of the highway which could not be destroyed by mining operations. Now, by a mutually satisfactory arrangement, the hydraulic giants of the LaGrange Placer Mines, Inc., are being used by the California Division of Highways to tear down the remaining walls of sand and gravel in a summit cut to create a new grade for the highway and release the old right-of-way for new mining operations.

An underlying slope of rock foot-wall dipping at about 40 degrees to the south forms the north slope of the cut and permits unusually accurate shaping of one side of the cut. This great cut will be 290 feet deep and 2,500 feet long when completed. To date 5,500,000 cubic yards have been removed at a cost of 2.03 cents per yard against an estimated cost of 3.3 cents. Dirt is being moved rapidly. In April, 1935, the largest month of operations, 28,270 cubic yards a day was sluiced from the hill into the empty expanse of Oregon Gulch. The work is pushed 24 hours a day when water is available with a maximum of 2,375 cubic yards moved per hour and a minimum of 450 yards.

The snow waters are impounded in a reservoir high above the work, giving a maximum head of 575 feet for the hydraulicking and a maximum velocity of 160 feet per second through the 6, 7, 8 and 9-inch nozzles of the hydraulic giants or monitors as they are sometimes called. The streams are played on the varying materials which include sand, gravel, boulders, hard pan, clay and cemented gravel, at distances varying from 80 to 400 feet and the maximum discharge is about 56 cubic feet of water per second or 2 tons of water hurled at the bank. The efficiency of water use is very high on this work, each cubic foot used carrying an average of 17 per cent solids and a maximum of 41 per cent, compared with a usual carry of 12 to 14 per cent.

Hydraulicking

The initial problem of the engineers and the hydraulicking superintendent

Old Road To Become Mine in Right-of-Way Exchange as California Hydraulicks 7,000,000-Yard Cut

was the removal of a bad slide which was coming into the line of the new road and which also might cause some trouble with the pipe line and the giants themselves if it moved at the wrong time. A large portion of the 1,500,000-yard slide was removed first and then the giants moved to the opposite side of the cut and the remaining dangerous portion of the slide washed away.

Hydraulicking is continued day and night seven days a week during the time when water is available, but through an agreement between the mining companies and the sportsmen of the state no hydraulicking is done between July 15 and October 15 of each year. Thus the streams are clear and fishing is possible on streams that otherwise might be turbid with the placer mining operations. This is not true of the work near Weaverville as the turbid material has settled out before it reaches any stream. Work is shut down, however, in accordance with the agreement, and further there is almost no water available for operations at that time of the year anyway.

The LaGrange Placer Mines, Inc., started work in 1907 and much of the original equipment is still in use for the highway job. Leading from the reser-

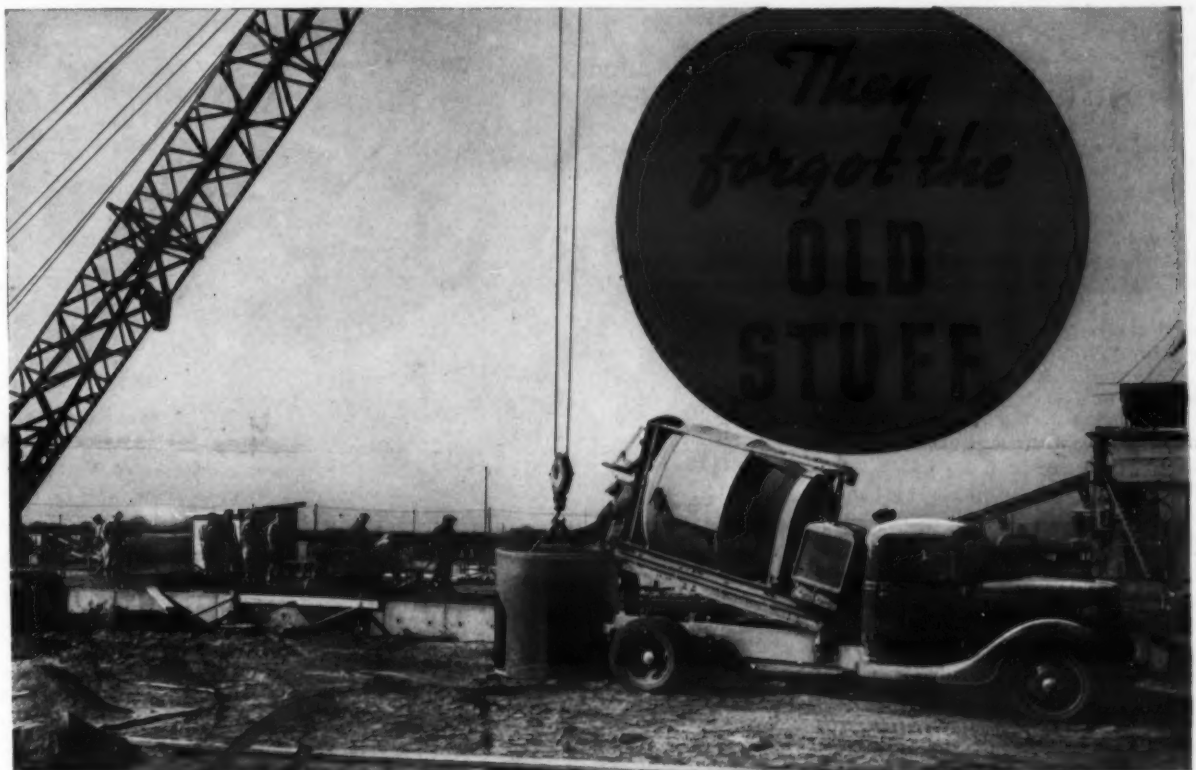


C. & E. M. Photo

Stalwart Posts Are Needed to Support The Triangular Wire Mesh

voir are 1½ miles of ditch, 1½ miles of wooden flume and 9 miles of steel pipe. The line leading to the giants consists of 60 feet of 36-inch pipe, 3,000 feet of 30-inch, varying short sections of 26 and 24-inch pipe tapering the line to

(Continued on page 21)



AS A *Chicago* HOUSING PROJECT Went Moto-Mix

Chicago, the last big city in the land without ready-mixed concrete, went Rex Moto-Mixer in placing the concrete on Trumbull Park homes, Housing Project H-1408.

The George A. Fuller Co. had used Rex Moto-Mixers on a housing project in another city. They bought more Rex Moto-Mixers and brought the entire fleet to Chicago for the Trumbull Park job.

They had learned how well it paid to forget the old stuff.

36,000 yards of concrete, placed in two- and three-story units scattered over an area one-quarter of a mile wide and one-half mile long, are being placed by Rex Moto-Mixers.

In 1937, before you buy, before you bid, forget the old stuff. Investigate the up-to-date methods of handling concrete.



REX READY-MIXED CONCRETE

Send today for a copy of the book—“Rex Moto-Mixers and Agitators.” It describes the 1937 way to secure a better margin on this modern, profitable method of selling cement and aggregates. It illustrates the 1937 Rex Moto-Mixer features.

CHAIN BELT COMPANY
1666 W. Bruce Street Milwaukee, Wis.



USE RIGHT BUCKET FOR THE JOB



Hayward makes all four — clam shell, drag-line, electric motor, orange peel. A Hayward recommendation is unprejudiced.



THE HAYWARD CO., 32-34 Day St., New York
HAYWARD BUCKETS

REX

The Up-to-date Method of Handling Concrete

Moto-Mixers

CHAIN BELT COMPANY of Milwaukee

Oil-Mat Surface Laid By Contract

**New Mexico Constr. Co.
Completed 17.5-Mile Job
with Rock Asphalt Top
West of Albuquerque**

(Photo on page 52)

THE New Mexico Construction Co., Inc., of Albuquerque, N. M., started its work on Federal Aid Projects 178 A & B, totaling 17.5 miles, on September 15, 1935 and was forced to shut down on November 10 because of cold weather. Work was resumed May 23, 1936 and completed July 10. Unfortunately some damage to the road surface during the winter made necessary the repair and resurfacing of a portion of the base laid prior to the winter shut-down. The work consisted of preparing a 6-inch base course in place, a 1½-inch oil mat over the entire project and a ¾-inch top of rock asphalt.

The base had been in place for some time, having been prepared with new material watered and rolled under another contract. On this contract some caliche was added to stabilize the base but the water would not mix with the base material added. As the base was still loose a tack coat of MC-1, a medium-cure asphaltic oil, was applied at the rate of 0.35-gallon per square yard and rolled after setting for 24 hours. Under these conditions it did not pick up and did give a uniform stable surface for the laying of the oil-mat top. This work was completed during the fall of 1935 but unfortunately the 4 miles of base nearest Albuquerque, as far west as the TWA airport, went to pieces, probably due to quite heavy traffic to the airport during the winter.

To repair this section it was scarified to a depth of 1½ inches and processed by road-mixing with MC-3 asphaltic oil, an asphaltic oil of lower penetration than the MC-1, and laid down 24 feet wide, giving a full-width stable base. This was followed with the laying of the 1½-inch oil mat over the entire project. Some of the oil mat placed in the fall also travelled during the winter due to the heavy snow, so about 5 tons of aggregate from 1½-inch stone down to 10-mesh material was added for each 100 feet of 20-foot surface and processed with MC-3 asphaltic oil. This was spread and rolled over the disintegrated mat to give a new 1½-inch mat.

After the oil mat, either reprocessed or new, had been in place and curing for 30 days a layer of rock asphalt was spread with a chip spreader and rolled to a final ¾-inch thickness. Santa Rosa rock asphalt, produced in New Mexico and having a uniform asphalt content of 7 per cent asphalt with a sandstone base, was used throughout.

The oil mat was primed with 0.4-gallon per square yard of SC-2 oil, an asphaltic oil of slow curing properties, before the rock asphalt was spread at the rate of 78 pounds per square yard. This tack coat was allowed to cure for 4 to 7 days, depending on weather conditions, before the top was applied.

Details of Base Preparation

The base of this road which is a new



C. & E. M. Photo

Hauling Gravel from the Crushing and Screening Plant

cut-off on the main route to Gallup, N. M., and Arizona, and is practically ruled across the face of the state, has a 6 per cent grade 2 miles in length at the Albuquerque end and was gravelled in 1935 to permit traffic to use it prior to the present improvement. This material was windrowed to the side to permit work on the base. In processing the base to stabilize it after the caliche had

failed, an asphaltic oil, MC-1, was used with 65 per cent asphalt.

Getting Out Mat Aggregate

To the average road man, at least east of the Mississippi, gravel comes from glacial deposits in banks. To the New Mexico and Arizona highway engineer the gravel should come from pits dug

(Continued on page 47)

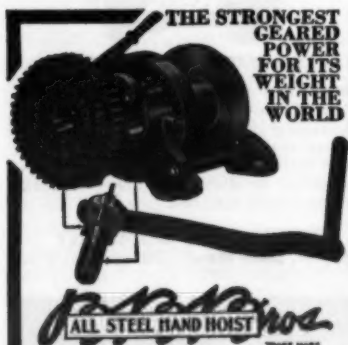
KOEHRING

new 503

Koehring offers another new model for 1937 — The 503 with selective swing speeds, anti-friction bearings, enclosed gears — a fast machine with abundant power for all types of work. Shovel has the Koehring Chain Crowd, all-welded boom and the exclusive boom foot shock absorber. Write for bulletin today!

See us at the Road Show in New Orleans. Ask us for complete information about Koehring Construction Equipment . . . Booths Nos. B9, B10, B27, B28.

KOEHRING COMPANY
Pavers · Mixers · Shovels · Cranes · Draglines · Dumpers · Mud-Jacks
3026 WEST CONCORDIA AVENUE, MILWAUKEE, WISCONSIN



**THE STRONGEST
GEARED
POWER
FOR ITS
WEIGHT
IN THE
WORLD**

BEEBE BROS.
ALL STEEL HAND HOIST

SEATTLE, U.S.A.

COMPACT—POWERFUL—SAFE
"For use where power is not practical or available"

Manufactured in 2, 5 and 15-Ton Sizes.
For capacity comparison, 1½" cable used:

2-Ton "Lightweight"	75 ft.
5-Ton "General Utility"	250 ft.
15-Ton Triple-Geared "Special"	1200 ft.

Patent instant gear change and positive internal brake that never fails, and will lock load.

Gear Ratios	Weight	Price
2-Ton 4 & 22 to 1	60 lb.	\$50
5-Ton 4 & 24 to 1	110 lb.	\$75
15-Ton 4, 19 & 109 to 1	600 lb.	\$200

BEEBE BROS.

2724 6th Ave., So., SEATTLE, WASH.
Warehouse stocks for dealers' supply: Seattle—Chicago—Brooklyn—Houston. Complete Literature and List of Dealers in Principal U. S. Cities and Foreign Countries Gladly Mailed.

Advances in Diesels For Truck Operation

A great deal of interest was aroused by the new models of diesel-operated trucks and buses exhibited at automotive shows throughout the country. This application of the diesel engine shows the progress which engine manufacturers have made in their efforts to bring low-cost diesel power to operators of trucks. Not so very long ago, the diesel engine, in spite of its operating economy, was suitable only for stationary use in large power houses, or in heavy-duty marine installations on ocean liners, freighters and tugs.

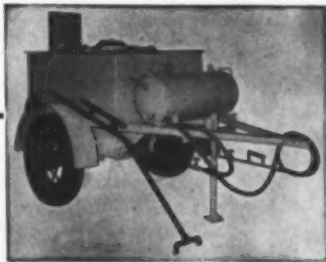
Until recently the injection of fuel oil into the engine cylinder was usually done by means of air pressure, which meant auxiliary equipment in the form of a compressor system. This extra equipment made it impractical to use diesels in mobile installations such as on tractors, construction equipment, trucks and buses.

The development of the solid injection principle of forcing fuel into the engine cylinder ended these difficulties. It did away with air compressors and pressure tanks, and replaced them with a small mechanical unit scarcely larger than a magneto.

Automotive types of diesel engines were first used on tractors and industrial machinery such as power shovels, road building equipment, etc. In these fields they have been outstandingly successful but for some time they could not compete with the gasoline engine in truck and bus service. This was mainly because they lacked satisfactory acceleration and flexibility of speed. Engine builders accepted the challenge and developed the automotive diesels which are used so successfully in trucks and buses today.

At the Chicago Automobile Show, the Diamond T Motor Car Co. showed a 1½ to 3-ton model and a 2½ to 4-ton model diesel-powered truck using Hercules diesel engines equipped with fuel injection pumps, spray nozzles and vacuum governors supplied by the United American Bosch Corp. This latter company has pioneered in the development of the solid injection principle for more than a decade and they even operated a diesel truck as far back as 1927.

This particular vehicle created a sensation in January, 1928, by making a trip from New York City to Cleveland, Ohio, where it was featured at the American Road Builders' Association Convention. While essentially an engineering test, the trip was highly successful from a commercial standpoint because the truck carried all the exhibit equipment sent to the show, plus six drums of fuel oil, a total pay load of 2 tons, and made the trip without mishap in January under severe winter operating conditions. An inexpensive grade of fuel oil was used at the rate of 11.5 miles per gallon. This truck remained in active commercial service for over 6 years.



TAR KETTLES
Fire Proof—Oil Burning

Hand and Motor driven spray.
Many sizes. Write for catalog.

White Mfg. Co.
ELKHART INDIANA



The New G-E Arc Welder

New Low-Range Arc Welder For Maintenance Work

A new low-range direct current arc welder, with ample capacity for welding all light-gage truck parts for construc-

tion or maintenance work, has been announced by the General Electric Co., Schenectady, N. Y. A feature of this welder, which is designed to operate on 3-phase, 50 or 60-cycle power, 230, 440 or 550 volts, is the use of rectifier bulbs instead of rotating equipment.

The unit is light in weight, easily portable, and has a current range of from 25 to 75 amperes, controlled by a nine-point tap switch. It is mounted on hard-rubber casters for easy moving and weighs 140 pounds net. Its overall dimensions are 27 inches by 24 inches by 14 inches.

New Distributors for Haiss Equipment

George Haiss Mfg. Co., Inc., New York City, has announced two new distributors of its line of loaders, conveyors and clamshell buckets. Howard W. Read Corp., 600 North Delaware Ave., Philadelphia, Pa., will handle the Haiss line in the Philadelphia territory and

IMPROVING FOREST ROAD



An Austin-Western Grader Pulled by an International Tractor On Which a Bulldozer Was Mounted, Widening a Forest Road in Texas

the Tennessee Tractor Co., 419 Twelfth Ave., S., Nashville, Tenn., will represent this manufacturer in the Nashville territory.

10 TIMES MORE Diesel service hours with SINCLAIR TENOL



Sinclair Ten-ol is a special alloyed lubricating oil developed for "Caterpillar" Diesel engines by Sinclair Refining Company. During the past several months this new Diesel lubricant has been put through exacting research laboratory and field tests.

In full power comparative laboratory tests, "Caterpillar" Diesel engines lubricated with Sinclair Ten-ol gave ten times as many service hours without shut-down as the finest straight mineral oils. In the average of all tests, consumption of Ten-ol was approximately one-half

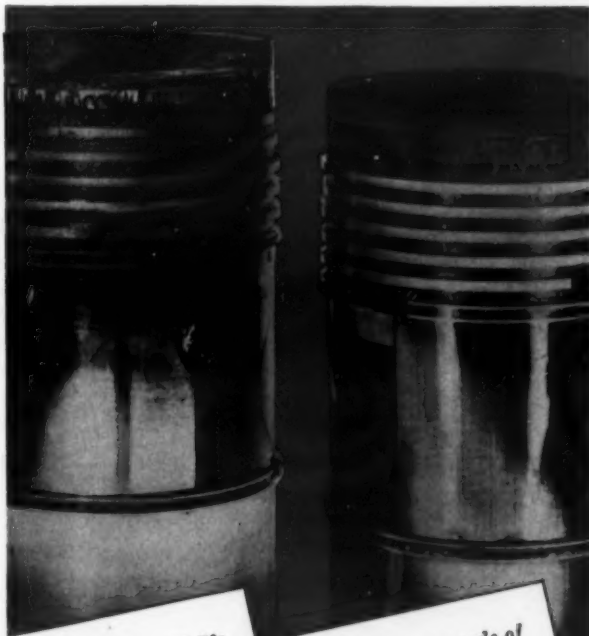
that of high grade mineral oils. In one of the tests a Diesel lubricated with Sinclair Ten-ol operated at extremely high overload with no damage to the engine and all lubricated surfaces kept in perfect condition.

Below are authentic photographs of test pistons taken after exacting laboratory tests. The piston photos have not been retouched. Read the captions under each photo—they tell the remarkable story of Sinclair Ten-ol's outstanding superiority. It will mean a tremendous saving in your own Diesel operation.

Sold by your local Sinclair representative.

Sinclair Ten-ol is recommended as a "New Outstanding Diesel Engine Lubricant" by the Caterpillar Tractor Co. Order Sinclair Ten-ol, Sinclair Diesel fuel and other Sinclair products from your local Sinclair office or write Sinclair Refining Company, 630 Fifth Ave., New York City.

Copyrighted, 1937, by Sinclair Refining Company (Inc.)



1 This piston was removed from a "Caterpillar" Diesel engine after an accelerated laboratory operation test. A poor grade of straight mineral oil was used throughout the test. Note the badly stuck rings which caused loss of compression, blow-by and excessive ring wear. Serious oil pumping was also caused by badly plugged oil control rings.

2 The finest grade of straight mineral oil was used to lubricate this piston in the same Diesel engine during an accelerated operation test of the same duration as No. 1. Poor piston seal is indicated by signs of excessive blow-by. Note the carbon-coated piston crown, sludge, plugged oil control rings and gum on piston skirt. Wear on liners is still excessive.



3 This piston was removed from a "Caterpillar" Diesel engine after an accelerated operation test ten times as long as that of No. 1 and No. 2 on the left. Sinclair Ten-ol lubricated the Diesel throughout the test. Note the absence of ring-sticking, the perfect condition of oil-control rings, freedom from blow-by and absence of gum on piston skirt. Ring and liner wear are negligible.

4 Here's the front side of the same piston (No. 3) after the test with Sinclair Ten-ol. Note that all piston rings are clean and move freely. Experts pronounce this the cleanest, most perfect Diesel lubrication job ever obtained. Sinclair Ten-ol multiplies Diesel service hours by ten!

Burlap Used to Reinforce Patching in Arizona

(Continued from page 1)

The burlap was then covered with premixed oil-mat material, rolled to a smooth even patch with a Wheeled Roller, and sealed with emulsified asphalt or cut-back. This type of roller is used because in the long distances that must be covered by the maintenance forces the transportation of a power

roller would be a real problem. The Wheeled Roller is pulled behind the regular maintenance truck from patch to patch. All patches of this nature are cut square for the sake of appearance on the road. The patch that meanders over the road is seldom well-made and certainly gives a sloppy appearance to the road surface.

The pre-mixed material for the patches is prepared in circles as described in the October, 1935, issue of *CONTRACTORS AND ENGINEERS MONTHLY*. These pre-mix circles are distributed throughout the state at intervals of about 20 miles

and close to gravel pits which have been approved by the materials testing laboratory of the state highway department.

Reduction in Gas Tax Increases Consumption

Following the reduction of the state gasoline tax from 4 cents to 3 cents per gallon in New York State last July, gasoline sales during July and August broke all previous records, according to a report of the American Petroleum Institute.

During the first six months of 1936, gasoline consumption in New York State was only 4.5 per cent greater than during the first six months of 1935, as compared with an increase of approximately 10.1 per cent for the whole country. The greatly increased sale of gasoline following the reduction of the tax rate brought the average gain in consumption for the first nine months of 1936 to approximately 10.1 per cent above the same period of 1935.

It is estimated that the 1-cent reduction in tax will save motorists more than \$15,000,000 annually.

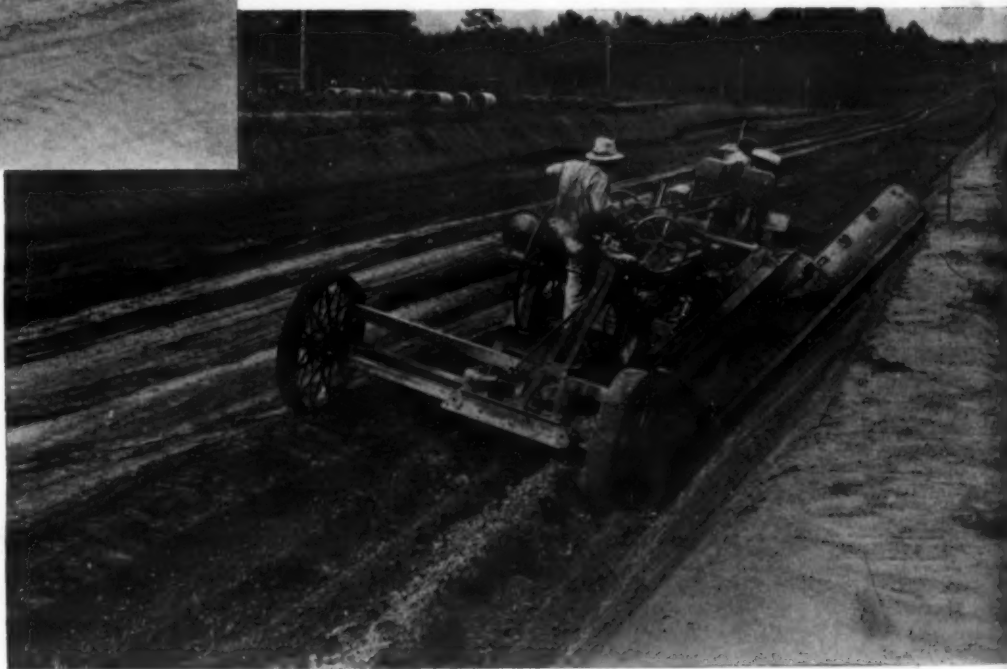
DO THE

Complete

C O N S T R U C T I O N



THOUSANDS of miles of America's roads have been constructed with "Caterpillar" equipment. And hundreds of thousands of miles are regularly maintained by "Caterpillar" Tractors and Road Machinery. The low costs and dependable power of this equipment recommend it for the complete road construction job as well as for maintenance.



ONE-HALF CENT A YARD FOR FUEL

Regrading and rebuilding an old road in Georgia, "Caterpillar" Diesel Tractors and Le Tourneau Scrapers move the dirt from cut to fill—a 700-foot haul—at a fuel cost of about 1/2 cent per yard.

CATERPILLAR

REG. U. S. PAT. OFF.

TRACTOR CO., PEORIA, ILLINOIS

Bell Joins A.I.S.C. Staff, Other Personnel Changes

Mace H. Bell has joined the staff of the American Institute of Steel Construction as district engineer for the southwestern territory, with headquarters at New Orleans. Mr. Bell was formerly with the U. S. Engineers Office at Zanesville, Ohio, as assistant engineer on design and construction of the dams in the Muskingum Conservancy project. He previously has been structural designer for several nationally known

firms of consulting engineers and has several years' experience in the fabricating industry.

The resignation of Robert J. Wood from the Institute staff to take a position with the Mississippi Valley Structural Steel Co. has made necessary a change in the territories of the district engineers. L. H. Dodd has moved from Dallas to take over the St. Louis office left vacant by Mr. Wood. Mr. Bell, from his headquarters at New Orleans, will head the territory which now includes Louisiana, Texas and New Mexico.

Link-Belt Personnel Changes, East and West

Announcement has been made by the Link-Belt Co., Chicago, Ill., of the appointment of P. B. Engstrom as the company's distributor for crawler shovels, draglines and cranes and locomotive cranes in Los Angeles and southern California territory, with headquarters at the Link-Belt office at 361-369 So. Anderson Street, Los Angeles. Mr. Engstrom is well acquainted with the West Coast, and was recently associated with

Garfield & Co., Link-Belt distributor in San Francisco.

Another change is the transfer of B. Howard MacNeal from Memphis, Tenn., to the Link-Belt office at 2045 W. Hunting Park Ave., Philadelphia, from which point he will specialize on the sale of crawler and locomotive cranes to industrial concerns in the Philadelphia and New York territories.

Ed. F. Carey, at Philadelphia, and Chester S. Lewis, at New York, will continue as the company's district representatives in their respective sales territories.

Job

WITH "CATERPILLAR" DIESEL TRACTORS

M A I N T E N A N C E

SPREADING GRAVEL FOR 10 CENTS ➤ AN HOUR

In Clay County, Mo., this "Caterpillar" Diesel Tractor (one of 8 this county owns) pulls a "Caterpillar" Grader — spreading and smoothing gravel for 10 cents' worth of fuel per hour. They cover 4 miles per day in second gear.



DITCHING AT LOW COST ➤

A "Caterpillar" Diesel Tractor and "Caterpillar" Grader is the economical unit used in ditching roads in Polk County, Georgia.



← FINISHING 1½ MILES A DAY

After the rough grading, "Caterpillar" Diesel Tractors haul "Caterpillar" Graders for the finishing work—cutting ditches and dressing a mile and a half per day—on less than 4 gallons of Diesel fuel per hour.



WORLD'S LARGEST MANUFACTURER OF DIESEL ENGINES,
TRACK-TYPE TRACTORS AND ROAD MACHINERY

Variety of Work On Cape Cod Canal

(Continued from page 2)

ferentiated chiefly by the method of placing. Each is placed in the dry insofar as possible, Type A being used where it is impossible to unwater the site and Type B where the work can be unwatered.

For Type A riprap, a 6-inch layer of crusher-run stone varying in screen size from $\frac{5}{8}$ to $2\frac{1}{2}$ -inch is spread down the 1:2 slope from about 5 feet above mean high water to mean low water and then for a distance of 5 feet out from the toe of the slope and up against a small dike which usually just shows above mean high water. This layer or blanket of small stone prevents the large stone from sinking into the soft bank when it is spread. The riprap proper is an 18-inch layer of stone varying from 50 to 300 pounds in weight. In Type A revetment a pile of this stone is left extending to just above mean high water at the toe of the slope so that when the soft dike is washed out, the large riprap stone will drop into the hole and prevent undercutting of the bank.

Type B revetment is essentially the same as Type A except that it is placed entirely in the dry, eliminating the necessity of the pile of large riprap stone at the toe of the slope. Areas varying from 30 to 300 feet in width are excavated behind 20-foot dikes left at the edge of the present canal and the areas carried to 5 feet below mean low water. Cross dikes are maintained at varying distances, depending upon the ability of the contractor's pumps to keep the site completely unwatered. The revetment stone is placed in the same manner as for Type A revetment, except that it is all placed in the dry. It is carried from 5 feet above mean high water to 5 feet below mean low water and with no pile of the riprap stone at the toe of the slope.

Placing Riprap

The placing of both small and large stone is done by skip, which minimizes the amount of hand labor necessary to trim the slope. All of the small crusher rock stone for the 6-inch blanket is placed by stone skips except on the Tomasello contract where it is handled by clamshells. Every truck delivering stone, whether small or riprap, is weighed on the U.S.E.D. scales but on



C. & E. M. Photo

Dikes and Cross Dikes at the East End of the Canal Which Permitted Dry Excavation and Are Now Ready to Be Dredged Out

the south side of the canal where the stone is delivered by rail, the railroad weight is accepted. The Acushnet stone, weighing 165 to 175 pounds per cubic foot, is hauled by $1\frac{1}{2}$ -ton or larger

trucks from the quarry to the north side of the job where the trucks are dumped into the stone skips. From one-third to one-half of a truck load is dumped into the stone skip at a time, the smaller

amount being necessary when the crane is placing riprap on the lower section of the slope and the larger when the radius of placement is shorter for the upper section of the slope.

The stone from the New Haven Trap Rock Co. weighs about 188 pounds per cubic foot and this portion is delivered by rail to the south side of the canal on flat cars with sideboards and is unloaded entirely by hand to trucks and thence to stone skips for actual placing.

Work at the Fish Pier

The L. E. McLaughlin Co. of New Haven, Conn., was the contractor for the new bulkhead at the location of the fish packing plant between Stations 18 and 36 on the south side of the canal. In this section the new bank line of the widened canal is some 200 feet back of the existing bank line so that all the work of preparing the steel sheet pile bulkhead was done in the dry before excavation began. A Speedcrane swung the Lackawanna DP1 steel sheet piling,

(Continued on page 32)

CLETRACS *help the nation* MAINTAIN LEADERSHIP

A NATION'S civilization is marked by its transportation facilities. Thus, the biggest single evidence of progress is the building of good roads. For more than 20 years, Cletracs have been used on highway departments in hundreds of counties because Cletracs have the power, the speed and the maneuverability needed for cost-cutting earth moving.

Another thing—the availability of special equipment increases the usefulness of Cletracs. This special equipment can be attached without altering the tractor in any way and without any undue stresses or strains on the tractor. Side frames are drilled and have tapped bushings to facilitate the mounting of trail builders, bulldozers, front end loaders, snow plows and all equipment that can be carried on the side.

Cletrac manufactures crawler tractors *exclusively*. Cletrac's slogan "Built to Endure" means continued low cost operation because long years of experience, fine steels, durable heat treated parts and precision workmanship are all built into every Cletrac model.

Do you want more for your money? We will gladly show you how Cletrac gives it to you.

THE CLEVELAND TRACTOR COMPANY • Cleveland, Ohio

Cletrac will be at the Road Show, Booths B 35 and 36, B 41 and 42.

LAYING BLACK TOP?



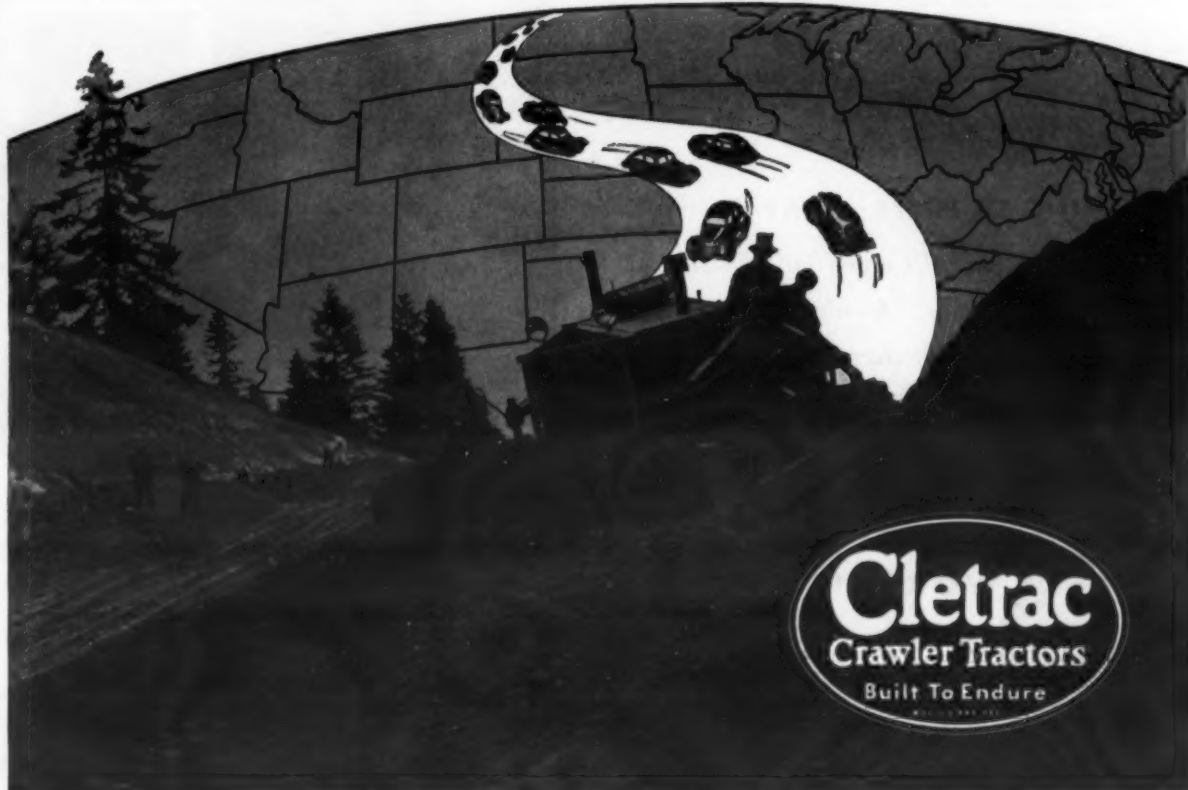
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Write for New Catalog, Prices.

THE JAEGER MACHINE CO.
701 Dublin Ave., Columbus, Ohio

JAEGER



Cletrac
Crawler Tractors
Built To Endure

Picks and Shovels

(Continued from page 1)

motoring public of tomorrow, on this subject of safety.

All of this effort is most laudable and we concur with all our heart. But while all this is going on and thousands—nay, millions—of dollars are being spent to promote safety, one of the most powerful educational forces in this country, the movies, is consistently undoing much of this good by portraying their heroes and heroines indulging in the most flagrant disregard of the rules of safe driving.

Example Important

In one picture released not long ago, and widely viewed and enjoyed, the glamorous heroine tore down the street, swerving the wheel of her automobile at such a rate that any normal car would have gone careening from one side of the street to the other, endangering the lives and property of the large number of people who would be passing along such a street.

In another much-discussed movie, one of the most idolized of the younger movie heroes streaks down a congested country road, supposedly filled with traffic from a largely-attended college football game, tears around a corner on two wheels, nearly running down the heroine of the piece, and finally brings the car to an abrupt halt which would have broken most people's necks. Shortly after this, there's the horrible example, made not horrible but very romantic and supposedly very amusing, of the same hero so drunk that he is totally unaware of what he is doing (as subsequent events prove) driving around the country at a break-neck pace in the same high-powered roadster. After a little more of this sort of thing, there is the final fadeout showing the hero and heroine, with all their troubles behind them, driving along, engrossed in a very romantic conversation, the hero apparently skillfully manipulating the car while he gazes ardently into the heroine's eyes, with never a glance at the road.

Those of us who are prosaic enough to be able to forget the romance and remember that he would probably have landed up a telegraph pole, at least, instead of in the heroine's arms, had he tried such antics on a public highway rather than on a movie lot, know that such things simply can not be done. To such people, with adult, mature minds, who probably are careful drivers now, this sort of thing can do no harm.

But there are the millions of impressionable young people, the new drivers of today and the habit-formed drivers of the future, to whom the actions of a character played by their favorite movie star are criteria for all aspects of living, who see only the thrill and dash and adventure in such flagrant disregard for traffic rules and safety, still unaware that little of the life on the silver screen can be lived in reality.

The Comic Relief

Slapstick comedy is disappearing to a great extent but the old stand-by for comic relief was a chase involving our hero and the cops, the hero outwitting the police by a series of impossible and supposedly very funny maneuvers with a car, dashing in and out among the cars on a congested street at a pace beyond all reason or practicability, while the audience roars with laughter. They tell me that this sort of thing is still shown in many of the smaller motion picture theaters, and is still reputed to be funny.

The Solution

There can be no doubt of the effect of certain types of movies and movie characters upon youth. The disastrous results of the gangster cycle of pictures aroused the general public so much that

there has been a great change for the better in the movies of today.

There are those who would have our movies written, edited and acted for the ten-year-old mind. I am not one of them. But I do believe most emphatically that the movies could make a great contribution to the highway safety of this country, not by the glorification of the police or highway patrol, or by such a feeble attempt at safety propaganda as "And Sudden Death," but by forbidding the utter disregard of traffic rules and regulations by the actors and actresses in all pictures, particu-

larly when they are going to be allowed to get away with it.

We urge everyone to protest loudly and vigorously against the undermining of the excellent work being done to provide safe highways and safe cars and to show people how to use these agencies safely, by such glaring examples of careless, selfish, unintelligent driving being flashed across the screen of every movie house in the country.

If you can be persuaded to take your pen in hand in this worthy cause, by all means do so and write to Will Hays, President, Motion Picture Producers

and Distributors of America, Inc., 28 W. 44th St., New York City, urging that the powers that be in Hollywood who sit in solemn conclave on the permissible length of a fond embrace give at the same time some thought to the heroes' and heroines' examples of safe and sane driving. In any case, ask your own highway or safety organization to write, for if sufficient pressure is brought to bear, something will be done. Let's be consistent about this safety business and make it our business to see that safety on the highway is a fact, not a fancy.

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Book of A.S.T.M. Standards

The American Society for Testing Materials has just issued its 1936 Book of A.S.T.M. Standards. This triennial publication contains all of the standard specifications, methods of tests, recommended practices and definitions formally adopted by the Society.

The 1936 issue is in two parts, Part I giving in their latest form all A.S.T.M. standards covering metallic materials,

and Part II, all standards relating to non-metallic materials.

In each part, specifications for a particular class of material are given first, followed directly by the test methods, definitions, etc.

Copies of these two volumes, totalling 2,400 pages, in blue cloth binding, may be secured from the American Society for Testing Materials, 260 South Broad Street, Philadelphia, Pa. Price: \$7.50

for either part; \$14.00 for the two volumes.

The Economy of Acetylene for Welding and Cutting

A small booklet giving a concise presentation of the story of acetylene as compared to various other fuel gases sometimes used in welding and cutting operations has been prepared by the Air

Reduction Sales Co., Lincoln Building, New York City. The booklet gives the history of acetylene, brings out the fact that it is hotter than any other fuel gas, has a high heating efficiency and the comparative consumption of oxygen is shown in a series of diagrams which are of particular interest.

Copies of this booklet may be secured by readers of **CONTRACTORS AND ENGINEERS MONTHLY** by writing direct to the Air Reduction Sales Co.

AS WE ENTER 1937



INGERSOLL-RAND equipment will play an important part in construction work done during 1937. Machines are available in a wide range of sizes and types. Each embodies the very latest developments and improvements in metallurgy and in manufacturing methods. Each does more work at a lower operating and maintenance cost. You can no longer afford to operate badly worn or obsolete equipment.

Now is the time to take stock, to study your existing equipment and to decide what new machines you require to secure and successfully handle contracts to be placed in 1937.

Ingersoll-Rand Branches and Distributors everywhere are anxious to work with you and help you make the coming twelve months an outstanding year. We greatly appreciate the confidence you have shown in us in the past and solicit your continued patronage.



The new JA-45 "Jackhammers" drill more footage on less air.

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488-14

Indiana Prepares For Snow Fighting

The recent purchase of 194 snow plows and 61 graders by the State Highway Commission of Indiana to supplement its equipment already used in the removal of snow and ice from the traveled surfaces of its 9,000-mile state highway system brings up the snow fighting equipment to 520 snow plows and 366 graders. The new equipment is distributed among the 36 highway sub-districts, the major part being placed in the northern half of the state, where snow and ice are more general.

The state has also bought 40,000 feet of snow fence to be used along the state highways in the LaPorte and Crawfordville districts to keep snow drifts off the highways. Approximately 100,000 tons of sand and cinders, 500 tons of calcium chloride and 300 tons of rock salt has been stocked by the state highway maintenance forces for winter use. Sand and cinders, mixed with calcium chloride or salt, are spread on the traveled surface of snow or ice coated highways, particularly on hills and curves.

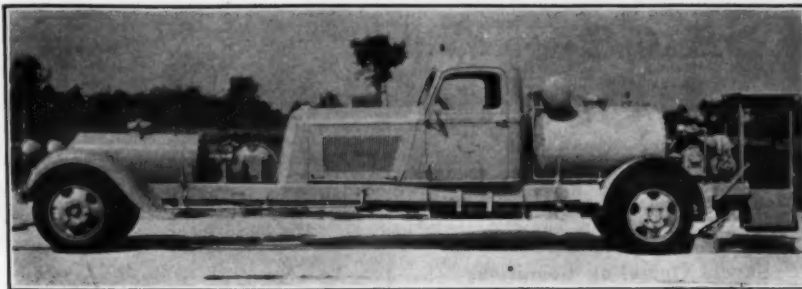
Last year snow and ice removal for the Indiana state highway system cost approximately one-third of a million dollars and during the sub-zero weather was accomplished at the additional cost of considerable suffering among maintenance workers who frequently were on the job from 24 to 36 hours. With the added equipment at its disposal, the Maintenance Division is planning a more effective service this winter. Using light plows and graders which operate at higher speeds than heavy equipment, the maintenance crews will go into action as soon as snow begins to fall or ice to form, instead of waiting until the highways have been covered or blocked.

New Center Line Machines For State Highway Depts.

The new center line painting machine, three of which have just been completed by the White Mfg. Co., Elkhart, Ind., for the Illinois Division of Highways and one for the State of North Dakota, follows the design of the long, narrow machines which are already being used by the State of Indiana.

The feature of these machines is their long wheelbase and narrow tread. The Illinois machines have a wheelbase of 19 feet and the North Dakota and Indiana units have a wheelbase of 24 feet. This length enables the driver to maintain a straight line without preliminary marking of the highway. The tread of these units is only 36 inches and they are only 48 inches wide overall, enabling them to paint the center stripe while traffic can pass on either side.

The driver's seat is located amidships, and at the front end of the machine is a triangular sight, somewhat like a rifle



The White Center Line Painting Machine In Use by the Illinois Division of Highways

sight. The top of this triangle spans a 20-foot road a short distance ahead of the vehicle while the vertical line in the sight gives the exact center of the road.

The actual painting is controlled at the rear and the marking box can paint one, two or three lines, using different colors if desired. Where pigment base paint only is used, both tanks are arranged with air-motor-driven agitators and suitable air pressure reducing

valves. The paint is thus forced to the spray box at the rear. If a hot bituminous material is desired for black striping, the rear tank is equipped with oil burners and the asphaltic paint is delivered to the spray box by a rotary pump. The machine is furnished with a small cab at the rear for the operator of the marking device, and has a two-way electric signal between the driver and the operator.

The chassis is propelled by a standard Dodge 6-cylinder engine and with standard transmission and driving gear. Especial care has been taken in the production of these machines with reference to camber of the front wheels and accuracy of the long frame.

When painting on long radius curves, the experience of the driver soon shows how to handle the machine to keep the paint box on the center of the traffic lane and a driver soon learns how to put a new stripe on top of an old one, and keep exactly to the center of the highway where a new stripe is being placed. These machines will not paint sharp radius or right angle turns.

These White center line painting machines are painting as much as 40 to 50 miles a day and the State of Indiana reports that their costs average \$15.00 a mile, covering all items of labor, material and amortization.

Complete information on these machines may be secured direct from the White Mfg. Co., Elkhart, Ind.



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A Line of Excavators
THAT HAS NO EQUAL
FOR POWER, SPEED,
AND ENDURANCE

3/4 YD.
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1 1/4 YD.
1 1/2 YD.
1 3/4 YD.
2 YD.
2 1/4 YD.
2 1/2 YD.
*** 3 YD.**

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25 to 1—4 to 1—1 to 1



Capacity	Weight	Cable Car	Price
5-Ton	135 lbs.	325' 1/2"	\$75.00
3-Ton	75 lbs.	150' 1/2"	\$55.00

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Ramsey Machinery Co.
 PORTLAND, OREGON

Greasing the Skids At Grand Coulee

**Lubrication Engineer,
a Most Important Man,
Systematizes Care of
Contractor's Equipment**

By HENRY W. YOUNG

(Photo on page 1)

SO great are the requirements for lubricants, fuel oils and gasoline at Grand Coulee that one of the large Pacific Coast oil companies has established a major plant there for the distribution of petroleum products. To attempt an analysis of the whole lubrication problem presented by this undertaking would take the investigator into practically the whole realm of lubricants, from the most refined and costly instrument oils to the heaviest greases used on the massive materials-handling equipment, and space does not permit going into the subject in all its ramifications.

The Mason-Walsh-Atkinson-Kier Co., however, does have the matter of lubrication down to an organized system. Perhaps by making a few observations as to the application of this system to one broad group of the construction equipment, namely, trucks, tractors and crawler wagons, some idea may be gathered in regard to what they are up against in "making the wheels go 'round."

One of the dictionary definitions for grease is "to bribe." In that case, the man directly responsible for keeping all the equipment up to snuff might be charged with bribery. If there is any place where heavy machinery has to be bribed and have the skids properly greased to get things done it is at Coulee. J. V. Devine, as master mechanic, knows the ropes in connection with this greasing business. But he cannot see to all the details, so a special lubrication engineer, William Warrens, is employed, who with a considerable staff inside and out in the field is in direct charge of all petroleum products and their use.

That Warrens manages quite a business is indicated by the fact that the average month's work at the present stage of operations requires such surprising totals as 90,000 gallons of gas; 3,300 gallons of internal combustion automotive oils, not including that required for tractors; 13,000 gallons of lubricating oils; 3,200 gallons of automotive greases.

In the early fall of 1936, there were 117 pieces of truck, tractor and crawler equipment in operation, to which may be added thirteen company-owned passenger cars. Calling the roll of this equipment we have:

- 10 White 12-yard trucks
- 15 Mack 12-yard trucks
- 3 Linn 10-yard truck-tractors
- 3 Allis-Chalmers 75's
- 23 Caterpillar Seventy-Five diesels
- 2 Caterpillar Forty diesels
- 16 Athey 12-yard buggies
- 6 Woodridge 25-yard buggies
- 7 International 1 1/2-ton trucks
- 4 International 3 1/2 to 4-ton trucks
- 9 International 1/2-ton pick-ups
- 2 International 1 1/2-ton dump trucks
- 6 Chevrolet 1/2-ton pick-ups
- 3 Chevrolet 1 1/2-ton field welding trucks

- 3 Dodge 1/2-ton pick-ups
- 1 Dodge 2-ton truck
- 2 Ford 1 1/2-ton pickups
- 1 White 2-ton truck
- 1 GMC well drill truck

Severe Operating Conditions

High quality in lubricants is sought all down the line. While costs are watched closely and systematically, the cost of lubrication materials is made secondary to operating efficiency. That is one of the principles on which M-W-A-K Co. runs this job. The conditions call for it and here are some of the conditions, applying particularly to truck and tractor operation.

The climate is severe, ranging from great heat in summer to zero weather in winter. In the summer it is dry, with the dryness of the desert. Winds howl up and down the gorge and fill the air



A Corner of the Main Oil House, Showing the Drums of Motor Oil, Oil Pumps, a Supply of Anti-Freeze, and an Oil-Reclaimer in the Background

with dust of almost impalpable fineness. This permeates everything, and much of it being of volcanic origin, it is highly abrasive. Then at certain times heavy rains come, and turn the place into a sea of mud, especially in the excavations.

Roads have been constructed over most of the area so that now the mud problem is not as great as it was a year ago. The trucks have to pull their loads up out of holes, through mud or dust, and

(Continued on page 41)

EASTER & LOAD HAUL & DUMP!



Loading with
a 5 yard



Hauling with
a 10 yard



Dumping with
a 7 yard

Continental Wagon Scrapers Load, Haul and Dump Faster!

They are strongest, yet lightest in weight, per yard of capacity. They move more dirt—greatly cutting digging, hauling, dumping and spreading costs.

Only Continental Wagon Scrapers have the outstanding advantage of rear dumping for backfilling entirely over a bank or edge of a fill, over culverts, against walls or backfilling into water.

They out dig any Scraper built because of the narrow cutting edge and the rugged stability of the two-wheeled design.

The Continental Patented Front Apron forms a part of the carrying bucket, providing the largest load carrying capacity for the tractor power available.

Continental Wagon Scrapers are made in 5, 7 and 10 yd. sizes for use with all sizes of crawler tractors.

No matter what your dirt moving job may be—in solid clay, rock, hard pan, shale, gravelly soils, gumbo, soils with rock or root inclusions, etc., Continental Wagon Scrapers will load, haul, and dump faster, reducing your costs to a minimum!



Send today for the facts!

CONTINENTAL ROLL & STEEL FOUNDRY COMPANY

Tractor Equipment Division

EAST CHICAGO, INDIANA

**AMERICAN CONCRETE
EXPANSION JOINT CO.**
221 N. LA SALLE ST., CHICAGO, ILL.

ACE-JOINTS



J-BARS

NEW ORLEANS ROAD SHOW
BOOTHS C15 and C20

Standards on Petroleum Products and Lubricants

The 1936 compilation of "A.S.T.M. Standards on Petroleum Products and Lubricants" which is sponsored each year by Committee D-2 of the American Society for Testing Materials, contains in the latest approved form fifty-six methods of tests, five specifications and two lists of definition of terms relating to petroleum and to road ma-

terials.

The 1936 report of Committee D-2 discusses the research and standardization work, details the changes made in the standards, and also gives four proposed methods which have been approved for publication as information and for comment. The report also gives suggested uniform automotive engine lubrication recommendations.

Standards are given in the publication pertaining to a large number of

petroleum products, including kerosene oils, lubricating oils, refined petroleum oil, gasoline, naphtha, natural gasoline, grease, bituminous materials, fuel oils and emulsified asphalts.

Copies of this 372-page publication, with heavy paper cover, can be obtained from American Society for Testing Materials, 260 South Broad St., Philadelphia, Penna., at \$2.00 a copy. Special prices are in effect on orders for ten or more copies.

Autocar Appointments

Autocar Co., Ardmore, Pa., has announced the appointment of Adolf Gelpke as Chief Engineer and Edward F. Coogan as Sales Manager of its motor truck factory. Mr. Coogan was formerly Assistant Sales Manager under H. M. Coale, who is Vice President in charge of sales and Mr. Gelpke, Assistant Engineer under B. B. Bachman, who is Vice President of Engineering.

The Greatest Specification a Shovel or Crane can have



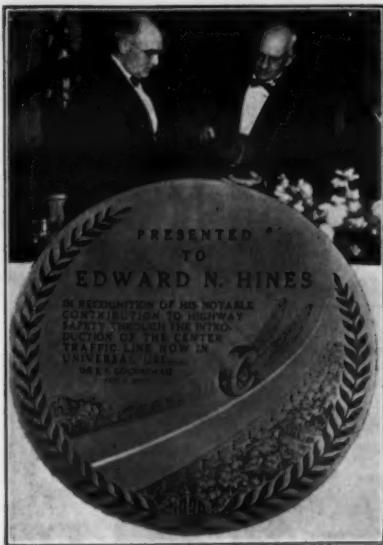
LORAINS • LORAINS • LORAINS • LORAINS • LORAINS

Is Thew Center Drive Design—In Turntable, Crawler, Shovel Boom

Step into the cab of any Lorain and you'll soon know what Center Drive means—a short cut from motor to smooth, powerful operations; rugged strength for extra heavy-duty service and long relentless grinds; a shovel boom with exceptional ranges; a two speed crawler, simple in design, agile and powerful in use . . . You'll realize that here is a shovel and crane designed to earn

profits not only for 1937, but for many years to come.
THE THEW SHOVEL CO., LORAIN, O. • THE UNIVERSAL CRANE CO.





J. D. Tew, President, B. F. Goodrich Co., Presents a Plaque (Shown in Inset) to Edward N. Hines, Originator of the Center Stripe

Center Stripe Originator Honored at AAA Banquet

Edward N. Hines, the man who originated the center traffic line now in universal use for marking highways, was honored for this contribution to motoring safety at the banquet concluding the thirty-fourth annual meeting of the American Automobile Association in November. Mr. Hines was presented with a plaque commemorating his contribution by J. D. Tew, President of the B. F. Goodrich Co., which some time ago instituted a search for the originator of the center traffic line idea.

In presenting the plaque, Mr. Tew said:

"Mr. Hines years ago conceived and put into execution the center traffic line, an idea which has probably contributed as much to motoring safety as any single safeguard now universally in use. It is a privilege to honor him."

Edward N. Hines has been a road commissioner for Wayne County, Michigan, since the inception of the Board of

Wayne County Road Commissioners over 30 years ago, and has originated many other highway safety ideas which have received general acceptance not only in Wayne County, but throughout the country as well.

Rolling Road-Mix With Rubber Tires

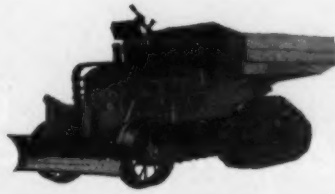
Road-mix surfacing is usually used where traffic is relatively light. Therefore, the annealing and consolidating effect of traffic which greatly improves the surface is not as rapid as could be wished by highway engineers. To speed up this process, the Wm. Bros Boiler & Mfg. Co., Road Machinery Division, Minneapolis, Minn., developed the Bros rubber road roller which carries nine 7.50 x 15 first grade balloon tires of standard make staggered with four in the front row and five in the back row above which is an electrically-welded steel platform 6 feet wide by 8 feet

long and 39 inches from the ground. Heavy material such as steel punchings, rock or sand for high compaction pressures can be loaded on this platform which has a drop center and a capacity of 40 cubic feet.

A few trips over a road-mix surface with this pneumatic-tired roller gives compaction equivalent to weeks or months of the light traffic usually found on roads of this type. This roller has

also been used successfully for compacting earth lifts on dams and fills because of its kneading action. On four successive tests of compaction carried on under the direction of the Illinois Division of Highways, one of these rollers with a 7,500-pound gross load on the first two tests and 11,500 pounds gross on the third test showed compaction of 26.7, 27.3 and 23.6 per cent after five rollings.

ESTABLISHED 1854



The CAMEL TRACTOR DUMP WAGON

Combines in One Versatile Heavy Duty Unit Features of Truck, Tractor, Trailer and Bulldozer. Goes where Trucks cannot. Handles easily in limited space, forward or backward. Four to five cubic yards capacity. Rough ground or soft spots are no obstacles. Increases capacity of power shovels or elevating graders. Send for descriptive circulars Dept. 37

SHUNK MANUFACTURING COMPANY, Bucyrus, Ohio, U.S.A.

The largest manufacturer of Road Grader Blades in the world



Fast DIGGING
Full CARRYING
Free DUMPING

RED ARCH dragline buckets dig with a quick fill . . . a smooth carry . . . a clean dump. They combine modern design with modern welded construction and modern lightweight alloy-steels. They are built to give increased yardage . . . and to deliver long-life service. Made in three types—"AU" "AX" and "Y"—for light, medium, and heavy digging, and in all standard sizes to 12 cubic yards. There is a RED ARCH bucket to fit your exact needs. Send today for illustrated bulletins.

205W

BUCYRUS-ERIE

EXCAVATING, DRILLING, AND MATERIAL-HANDLING EQUIPMENT...SOUTH MILWAUKEE, WISCONSIN

HERE IS THAT MUCH NEEDED

ACCURACY

for SPREADING SURFACE MATERIALS



Buckeye

Surface Material SPREADER

Lays Down Quantities up to 60 lbs. per sq. yd. UNDER POSITIVE CONTROL

Contractors using this distinctly different spreader equipment, report big savings in both time and material due to the accuracy with which measured volumes of material can be spread exactly where wanted. It works forward or reverse, equally efficient for new construction, resurfacing or patching. Truck speed does not affect accuracy of spread. Gets close to guard rails or other obstructions, spreading full width of the machine. Write for complete facts.

BID THE Buckeye WAY
ask for our operation data before you bid

The BUCKEYE TRACTION DITCHER CO.
Findlay, Ohio

Hydraulic Giants Make Highway Cut

(Continued from page 9)

1,000 feet of 18-inch steel pipe leading directly to the nozzles.

There are three monitor men for each nozzle per shift with ten pipe layers maintaining the line and six to eight laborers. In addition, on the checks and work of creating directional flows below in Oregon Gulch where the grade is being raised by the hydraulicking operations, there are some twenty-five men from a nearby prison road camp. The giants are moved from one part of the cut, which will be approximately 1,200 feet wide when complete, by attaching block and tackle to trees on solid ground around the rim and pulling the giant to the desired location. When the final cut is practically complete, the slope of the ground will be permitted to assume its natural angle by undercutting the toe and allowing it to drop and come to rest at a stable slope.

All joints on the pipe line, and particularly where there is an angle, are well loaded with rock to prevent whipping of the line when the water is turned into the line after a period of rest for changing the line. An example of the power of the water occurred at 4 o'clock on the morning of June 19, 1936. Suddenly a joint of the 18-inch pipe line gave way on the lower slope of the cut and completely wrecked one of the giants which was in the line of the stream, and a substantial shack 12 feet square housing a welding outfit and filled with the tools and rubber boots used by the men was swept away down the gulch with little possibility of recovering anything.

Town Engulfed with Gravel

The old gold town of Oregon City, located in the gulch below the work under way, is now buried beneath about 80 feet of mine tailings and 20 feet of material deposited as a result of the work of the highway department. Some of the men now on the work, old miners, can remember when the spire of the Catholic church was still visible above the rising tide of tailings.

The material is deposited all through the 5-mile gulch with the coarsest nearer the top. The grade of the fine material at the bottom is about 2 per cent, then about 6 per cent for the medium material including the smaller rocks and 18 per cent for the stone larger than 12 inches in diameter.

The Crib Dam and Spillway

To control placing of the material the use of a crib dam and various kinds of checks was necessary. The first operation when the work was started by the Division of Highways was to build a crib dam across the entire gulch or valley at the lower end of the hydraulic fill. This is 800 feet long and was built to a height of 10 feet. Now the material has built up to the top of the dam and only the spillway section at the south end is flowing. In building the cribbing each timber was tied to the next lower member by a length of 1/2-inch rein-

forcing rod driven into the top of the upper log and the under side of the lower timber.

The spillway is simply an open space at the end of the dam through which the water will flow and protect the hydraulic fill built up on the north side from being washed away by any future extensive hydraulicking operations by the mining company.

Creating the Hydraulic Fill

In order to build up the fill in the section desired, an elaborate system of checks has been built, using various materials. First, earth dikes were tried built up by tractors and bulldozers, but on the slopes of 4 per cent they were not successful. These were replaced with a system of wire fences and brush dikes that permit the water to run out and deposit the gravel and sand inside the check. Insofar as possible the water from the giants carrying the heavy material was directed to the north side of the gulch where several fills are necessary to maintain the maximum of 8



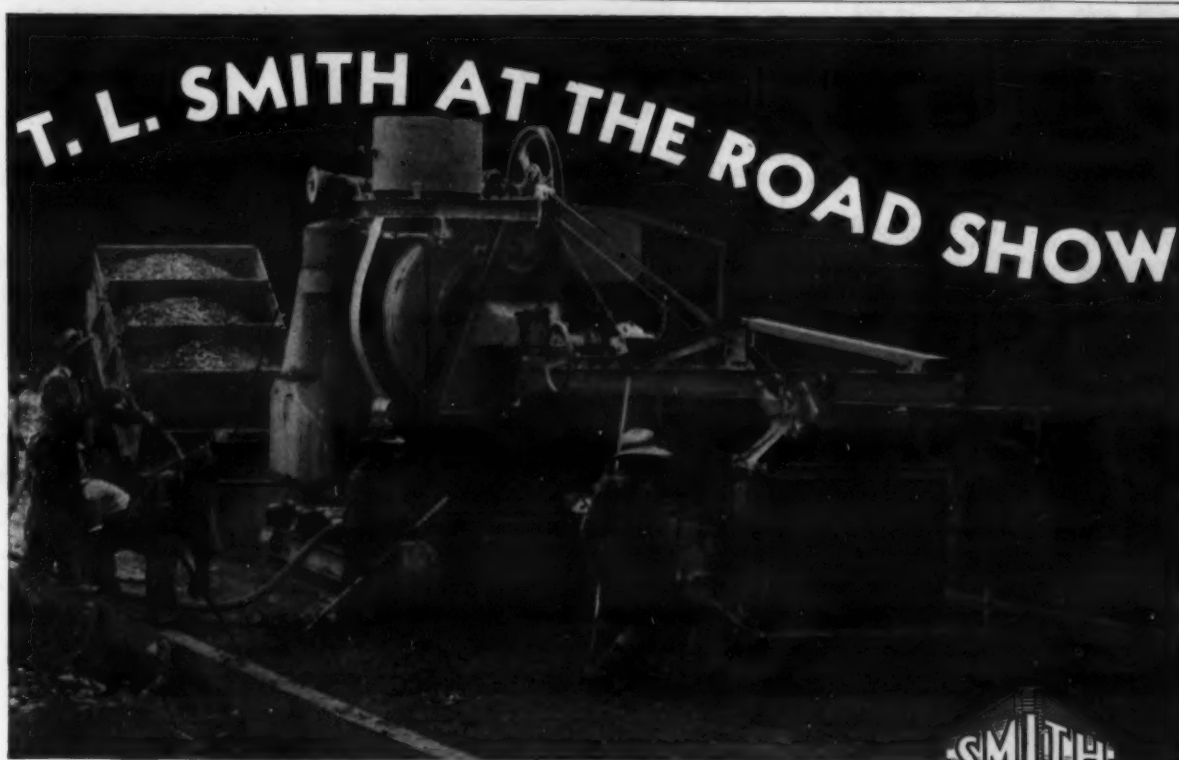
C. & E. M. Photo

A New Grade Through Oregon Gulch Is Being Built Up by Retaining Hydraulicked Material Behind These Brush and Wire Fence Checks

per cent in approaching the large cut above. This was done by temporary wooden flumes delivering the material from diversion dams in the main channel coming down the gulch. This 8 per cent maximum grade will replace the

present 12 to 20 per cent grade of the old county road. Fills from 20 to 40 feet have been built up with these brush and wire checks stepping them back as the material built up to the 5-foot lifts.

(Continued on page 43)



SMITH 27-E PAVER — the modern paver, built to meet today's requirements, and backed by Smith's 37 years leadership in the industry. Contains every device for high speed operation, dependability and low maintenance cost.



TWO WHEEL TRAIL-SMITH — the ideal mixer for bridge, culvert and similar jobs. Tows behind car or truck at fast driving speed. Turns in its own length. Fits into tight places. Move it fast — move it often.

VISIT the T. L. Smith exhibit at the Road Show . . . New Orleans, January 11 to 16, 1937 . . . Booths No. A-60 and No. A-61. Our engineers and sales representatives will be on deck to shake hands with our contractor friends, and to tell them about T. L. SMITH'S NEW MODERN MIXERS for road paving, bridge, culvert, curb and gutter, sidewalk and alley work.

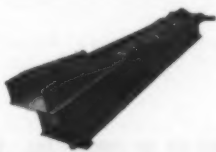
If you are unable to attend the Road Show, write for literature.

THE T. L. SMITH COMPANY
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THE BOULDER DAM MIXERS

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**CLEAN
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EAGLE WASHERS

Screw and Paddle type machines to meet particular washing and cleaning problems in sizes to suit capacity requirements. Send for bulletin W2 for complete information.

EAGLE IRON WORKS
DES MOINES, IOWA

Double Traffic Line Danger Signal In Calif.

One of the most important danger warnings on California state highways is the orange colored line painted in the center of the double white stripes dividing traffic lanes on four-lane pavements, curves and crests of grades, according to a recent article in *California Highways and Public Works*. Motorists are forbidden to cross these lines and the motor vehicle patrol officers are enforcing this regulation.

Because orange has been found to be

not clearly distinguishable in the glare of automobile headlights at night, the California Division of Highways is gradually eliminating the orange stripe between the double white lines in favor of black.

On four-lane highways the double line is continuous but on two-lane roads it is used on grade crests and curves only. Where it is in use, signs warning motorists that they are approaching the beginning of the double stripe are placed at the right side of the highway 400 feet from the point where the double line starts. These signs now read, "No Passing Over Orange Line On

Crests of Grades." The word "Double" will be substituted for the "Orange" on these signs.

Warco Reorganized, Receivership Past

The W. A. Riddell Co., of Bucyrus, Ohio, which has been operating under a receivership for three years, has now completely reorganized without change of name, except Corporation replaces Company. The reorganized concern will be in possession of all the assets of value and has dropped the idle plants and other unsatisfactory properties.

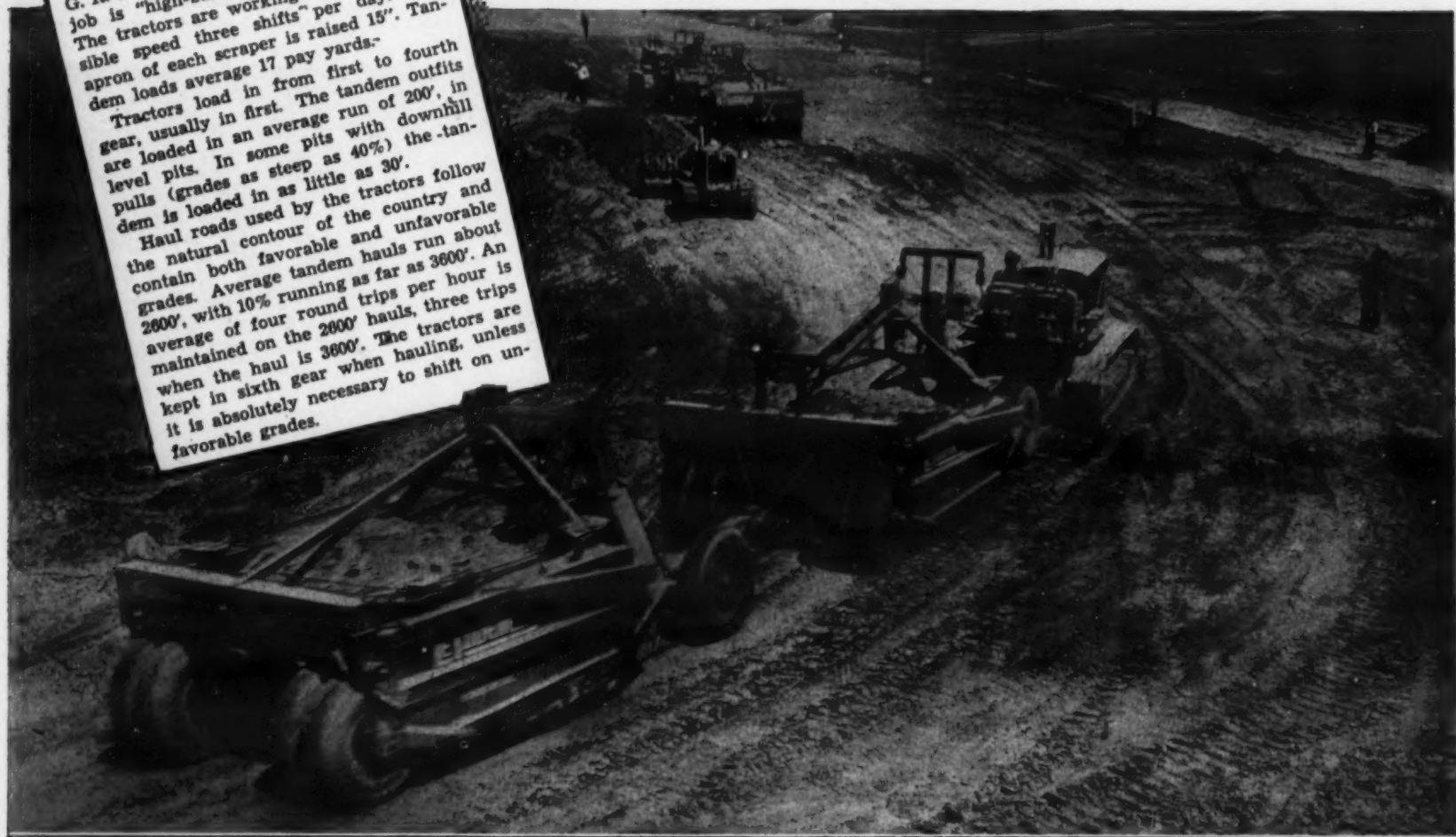
During the period of receivership under H. F. Holbrook, who now heads the reorganized company as Vice President and General Manager, the products of W. A. Riddell Co. have been constantly improved and several new products placed on the market, including an eight-wheel oscillating tandem drive traction unit called the Octopus, a four-wheel tandem drive called the Octopus-Tandem, a Multiplow Mixer and Leveler attachment for black-top road work, Warco J & S traction treads for heavy-duty pneumatic-tired equipment and a new Super-Modern streamline motor grader.

A MILLION YARDS WITH SCRAPERS—Under the energetic direction of G. R. Putnam, project superintendent, the job is "high-balled" to the nth degree. The tractors are working at highest possible speed three shifts per day. The speed of each scraper is raised 15". Tandem loads average 17 pay yards.

Tractors load in from first to fourth gear, usually in first. The tandem outfits are loaded in an average run of 200', in level pits. In some pits with downhill pulls (grades as steep as 40%) the tandem is loaded in as little as 30'.

Haul roads used by the tractors follow the natural contour of the country and contain both favorable and unfavorable grades. Average tandem hauls run about 2600', with 10% running as far as 3600'. An average of four round trips per hour is maintained on the 2600' hauls, three trips when the haul is 3600'. The tractors are kept in sixth gear when hauling, unless it is absolutely necessary to shift on unfavorable grades.

Two of the six LeTourneau tandem outfits at Cooney Dam, Montana. Says Utah Construction Company: "we made the proper choice of equipment for the job."



ROUND TRIPS OF 5,200 TO 7,200 FEET—

● 51 TO 68 CU. YDS. HOURLY PER TRACTOR

At Cooney Dam LeTourneau Carryall Scrapers and Caterpillar tractors again proved that long hauls can be profitably handled by tractors. There 12 LeTourneau 12-Yard Carryall Scrapers, operating in tandem hookups behind six Caterpillar RD8s, moved 1,000,000 cubic yards of material—all of it over round-trip distances of 5,000 feet or greater. The above reprint from "Pacific Builder & Engineer" tells the story.

Ask your Caterpillar dealer to show you what LeTourneau Carryalls and Caterpillar tractors can do on your long hauls.

R. G. LeTOURNEAU, INC.

Stockton, California

Peoria, Illinois

Cable Address: "Bobletorno"

Manufacturers of: Angledozer*, Buggies*, Bulldozers, Carryall* Scrapers, Cranes, Drag Scrapers, Power Control Units, Routers*, Semi-Trailers, *Name registered U. S. Patent Office.

LETOURNEAU

Snow Drift Control Along Ontario Roads

In an article on the general subject of winter maintenance of Ontario highways in a recent issue of *The Canadian Engineer*, C. A. Robbins, Resident Engineer of the Ontario Department of Highways, tells how drift prevention is handled there. Under the Highway Act which controls the construction and maintenance of roads in Ontario, the Department of Highways is permitted to erect snow fence on land adjoining the highway without compensation to the owners, except in the case of damaged crops. Such damage is rare and occurs only when snow fence has been erected on wheat lands. These claims are settled by negotiation and the expenditure in the whole of Ontario amounts to only a few hundred dollars a year.

For drift prevention, Ontario has standardized on a wire-bound slat fence about 4 feet high which is made in convenient-sized rolls of 100 feet in length. This fence is erected on steel posts, especially designed, which are driven solidly into the ground one rod apart at a distance of approximately 100 feet from the center of the road. The snow fence is hung on these posts by wire ties with the bottom of the fence a few inches from the ground.

Formerly this fence was stored along the right-of-way but a considerable footage was lost by theft so now all fence and posts are stored in a central storage yard. Up until 1935 this fence was always erected, maintained and stored by the regular maintenance forces but last year an experiment was tried on about 100 miles of road whereby the farmer on whose land the fence was erected undertook to erect, maintain and store all snow fence for the sum of \$1.25 per 100 feet under the terms of a special agreement. The farmer agrees to erect the fence where directed on or before the 15th day of November or as soon after that date as instructed and to erect it in a satisfactory manner. He further agrees to maintain the fence in a satisfactory condition throughout the winter months but the Department reserves the right to enter the property and make any necessary repairs which the farmer has failed to do and the cost of such repairs made by the Department are deducted from any payment due him under the agreement.

The payment is made after the fence has been removed in the spring, about the first of April, when the local maintenance patrol man certifies the farmer's invoice which must be in triplicate. The agreement prohibits the farmer to use the fence for any other purpose than for snow protection and he must store it clear of the ground during the months it is not in use.

This experiment proved very satisfactory and is being extended this year.

Engineering Fundamentals Covered in New Handbook

The Handbook of Engineering Fundamentals, edited by O. W. Eshback, E. E., M. S., and containing the contributions of forty engineers and specialists, is the first volume in the proposed new Wiley Engineering Handbook Series.

The first section of this 1,081-page book presents a selection of mathematical and physical tables, in which particular attention has been given to arrangement for general convenience. In addition to tables on engineering constants, properties of numbers, logarithms, trigonometric and hyperbolic functions, there is included a series of tables of conversion factors for weights and measures arranged in order of dimensional sequence, tables of integrals,

standard structural shapes, and physical properties of metallic and non-metallic materials.

Other sections cover the theory of dimensional analysis, fundamentals of theoretical mechanics and mechanics of materials with applications to beams,

columns, shafts and reinforced concrete; the modern theory of fluid mechanics; the theory of electric, magnetic and dielectric circuits; the fundamental principles of general chemistry; and many other subjects of interest to engineers, as well as a discussion of the

elementary legal aspects of contractual relations with which all engineers should be familiar.

Copies of this handbook may be secured from John Wiley & Sons, Inc., 440 Fourth Ave., New York City, Price: \$5.00.

ONE OF THE BIGGEST-EQUIPPED WITH PNEUMATIC TIRES

This Rogers Trailer, recently shipped into Los Angeles, is about the largest capacity trailer made, equipped with pneumatic tires. The REAR GEARS under the trailer consist of 8 wheels on 4 rocking axles, each wheel equipped with dual 8.75x15 12-ply tires. The front gear, or dolly, for this trailer is a small semi-trailer and the rear gear of this consist of 4 wheels on 2 rocking axles, each wheel equipped with one 13.50x24 16-ply tire.

ROGERS BROS. CORPORATION
Albion Penna.



The dock of this trailer is 11' wide, 18' from back of the gooseneck to front of rear wheels, loading height at the rear 35', loading height of dock 29' (without load), over all length of this trailer (as a semi-trailer) 38'6", overall length of complete trailer with semi-trailer-dolly 47'6".

There's a ROGERS to fit every TRAILER need. Sizes: from 5-100 tons.

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The choice of experience is an intelligent guide to equipment buying.

—for thirty years the design of Blaw-Knox Road Building Equipment has progressed with the industry to produce more efficient and time saving equipment.

It is new—better—always improved to meet the peak demands of modern road building.

—for 1937, join with Blaw-Knox in the front line of construction.

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ROAD
SHOW
New Orleans,
La.
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100 PER CENT
TRACTION**DYNAMITE****ON
WHEELS****FOUR POINT
POSITIVE DRIVE**

THE WALTER SNOW FIGHTER, the snow-battling vehicle that has earned for itself the title of **DYNAMITE ON WHEELS** by reason of its performance under severe conditions in all sections of the United States and Canada, gives the user more than just four-wheel drive in plowing through mountainous heaps of snow—without faltering or halting.

A WALTER MOTOR TRUCK is more than a four-wheel drive truck; it is a Four-Point Positive-Drive Truck. A four-wheel drive truck, in hard going, can and must slip two wheels while the other two stand still—**RESULT—50% Traction**. A WALTER TRUCK is equipped with three automatic locking differentials, which does not permit one, two or three wheels to spin or slip while the others stand still—**RESULT—100% Traction** at all times under any and all conditions.

GENERAL USE

A WALTER SNOW FIGHTER not only sees service in the winter. The plow can be removed from the truck and the unit can be used for general service. WALTER MOTOR TRUCKS are used in the oil fields of Texas and Oklahoma, for logging on the Pacific coast, and for general transportation at a low operating cost per mile. WALTER TRUCKS are good in any soft going. They always assure the user of the delivery of his cargo.

Walter Motor Truck Company

**1001-19 IRVING AVE.
RIDGEWOOD, QUEENS, L. I., N. Y.**

Relocation Job on Road in Wyo.

Northwestern Engineering Co., of Rapid City, S. D., Had Cuts, Fills, Six Channel Changes and Bridges on 11-Mile Project

IN Natrona County, Wyo., some 25 miles west of Casper, the Northwestern Engineering Co. of Rapid City, S. D., completed the rebuilding and relocating of 11 miles of U. S. Highway 20, eliminating curves. The job involved cuts averaging from 4 to 8 feet, fills of 3 to 18 feet, with a top of 30 feet, six small bridges or culverts, six channel changes and one 140-foot bridge with wooden piling. The excavation totaled 220,000 cubic yards.

An unusual mixture of about 40 per cent gumbo, 35 per cent shale and 25 per cent brule made tough going and required the use of a rooter to break it up. Dirt moving equipment on the job consisted of two Le Tourneau 12-yard Type J Carryalls, pulled by two Caterpillar RD8 tractors, a Le Tourneau bulldozer and Type S rooter, both on the same Caterpillar RD7, a Caterpillar No. 48 elevating grader, four Caterpillar Sixties, three hand maintainers with Caterpillar Sixties, ten Ford 1½-ton trucks, four fresno scrapers with six four-horse teams, two being held in reserve, and three 5-yard steel dump wagons.

The Carryalls were used for excavating the borrow pits, for the channel changes and for the heavy cuts, handling about 145,000 cubic yards. The bulldozer did the final blading, accounting for some 30,000 yards.

The elevating grader worked on the shallow borrows, the horse-drawn fresnos did the short cleaning up of the borrows, and the horse outfits, trucks and elevating grader handled the remaining yardage.

Traffic was routed over the job, being detoured only around culverts and bridges, and Caterpillar graders maintained a 7-foot road on each side of the highway. Paul Revis was Superintendent for the contractor on this project.

Arc Welding Manual.

The second edition of "Electric Arc Welding Manual" by W. J. Chaffee has just been published by Hobart Bros. Co. This book is designed as a manual and operator's training course in electric arc welding and includes the many developments in arc welding methods and applications as well as in arc welding equipment since the publication of the first edition in 1930.

The book contains nine chapters, covering the welding arc, welding equipment, weldability of metals, types of joints and welds, strength of welds, speed and cost of welding, using the metallic arc, welding with bare electrodes, and welding with coated elec-



The Rooter Preparing Ground for a 12-Yard Scraper on One of the Channel Changes

trodes. There is also a supplementary section, including information on welding equipment, an alphabetical index and an index to operators' training exercises.

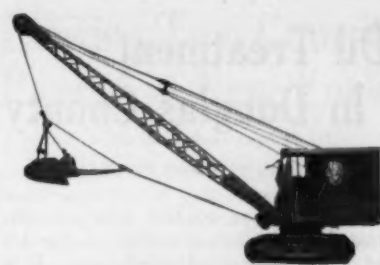
Copies of this handy 94-page well-illustrated book may be secured from the Hobart Bros. Co., Box CE-46, Troy, Ohio. While this book regularly sells for \$1.00, readers of CONTRACTORS AND

ENGINEERS MONTHLY may secure copies by sending 75 cents in stamps direct to Hobart Bros. and mentioning this magazine.

New Convertible Shovel That Is Full-Revolving

A heavy-duty ¾-yard machine that is full-revolving and fully convertible from a chain-crowd shovel to dragline, clamshell, crane, backhoe or for skimmer service has been announced by the Osgood Co., Marion, Ohio. This machine, christened the Invader, is mounted either upon continuous-tread crawlers or a commercial truck chassis.

With the 10-cubic foot struck-measure dipper, the shovel weighs approximately 23,700 pounds and the long continuous-tread crawlers with wide-tread shoes give the Invader unusual stability when used as a crane and a very low ground-bearing pressure for working or traveling on soft material. It has four travel speeds from 1 to 4 miles per hour and



The New Osgood Invader

a rotating speed of approximately six revolutions per minute. It is powered with a large 6-cylinder, heavy-duty gasoline or diesel engine or an electric motor. The fuel tank capacity is 64 gallons.

Details regarding the features of the Invader may be secured direct from The Osgood Co., Marion, Ohio, which now presents a full line of crawler-mounted, full-revolving shovels, cranes, backhoes, skimmers, etc., ranging in capacity from ¾-yard to 2 cubic yards.

Buy Cedar Rapids Roller Bearing Crushers

That Are Built On
A Foundation Of



IT IS
S. K. F.
BEARING
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GREASE
IT BUT
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DURABILITY

IT'S REVOLUTIONARY IN ITS SAVINGS OF LUBRICANTS —
A NEW AND PROVEN IDEA, BACKED BY AN OLD NAME
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IOWA MANUFACTURING COMPANY
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Visit Booth C-23 at the New Orleans Road Show

CHAINS

All kinds for
Contractor's use



Write or wire us

The Carroll Chain Company
Columbus, Ohio

Oil Treatment In Douglas County

(Continued from page 2)

In September of last year we oil-treated a suburban crosslink of 2 miles between two main state highways. This link was selected because it represents a type which demands frequent dragging and, due to grades, is subject to heavy erosion of wash and wear. The surface was first bladed to a width of 20 feet and smoothed, shifting to the shoulders the equivalent of $\frac{1}{2}$ inch of gravel, and leaving an average of $\frac{1}{2}$ inches of compacted gravel-filled base material. There was then applied $\frac{1}{2}$ gallon, to the square yard, of No. 2 road oil of 60 per cent asphalt content, which attained a penetration of $1\frac{1}{2}$ to 2 inches. The material which had been bladed out to the shoulders was respread by hand and, as it so happened, just about took up such free oil as had not penetrated the subsurface. The road was then opened for traffic to complete the job.

This 2 miles very successfully weathered the most severe winter in our history, two and one-half months of continuous snow and ice, and the terrific abuse of tire chains during that period must have given it a trial which can hardly again be anticipated.

The work cost \$539.55 per mile, of which \$185.59 was for labor and equipment and \$351.96 for oil, (6c per gallon). Oiling equipment was rented.

As to this experimental road, it was found that oiling with fairly light coats afforded a very satisfactory surface, frost boils were eliminated and that it dried much more rapidly than unoled roads.

It was also found that repeated light applications afforded a better mat surface, easier to maintain, and kept down the rank growth of weeds. It was upon these conclusions that the 1936 projects were formulated and constructed, and it is the intention to follow this method of oil distribution during the season of 1937 when the major portion of the highway system will have been oil-treated.

Due to the fineness of the Platte River gravel used under our County, State and Federal specifications, the lack of binder, and the relative hardness of the particles with their tendency to laminate, a large amount of the gravel has been ground under traffic, blown away or lost in the subsoil. To overcome this difficulty and preserve our original investment, it was decided to employ oil treatment to eliminate the dust as well as to bind the particles.

After exhaustive experimental work had been carried on by this Department, it was decided that an asphaltic oil with 40 to 60 per cent bitumen content is the most suitable for application on roadways and MC-2 for shoulders along paving, and steps were then taken to purchase those types.

Due to the Department's lack of storage and heating facilities, it was decided to advertise for oil, heated and stored, to be furnished in such quantities and at such times as funds were available for the purchase.

The Distributor

Considerable time and study were given to the purchase of a multi-use distributor and the following equipment was decided upon. It consists of a South Bend Model 200 800-gallon capacity bituminous distributor, mounted on an especially-designed GMC chassis Model T23-HB.

It was anticipated in the beginning that the unit would be so designed as to permit its use in the winter months when it is impossible to use the distributor. For this reason the chassis was purchased with an unusually heavy front axle designed for the purpose of mount-

ing a snow plow. This will be used for patrol purposes during the winter. Special attention was given to the rest of the chassis design so as to strengthen it for any unusual strain.

The tank of the distributor is elliptical so as to permit the lowest possible center of gravity and is also insulated. The distributor is also equipped with two Aeroil high-pressure generator-type burners. The Viking rotary pump has a capacity of 250 gallons per minute, 3-inch suction and discharge.

The distributor is also equipped with two Stewart-Warner tachometers, one for road speed and one for pump speed. There is a mercury-type thermometer, registering 50 to 500 degrees Fahrenheit which is permanently installed on the side of the tank in full view of the op-

erator.

Another feature of the distributor is a special reverse-suction attachment for the prevention of dripping from the nozzles when crossing over sidewalks and paving.

Last Season's Work

As to work done during this past summer season, there were 20.65 miles of road, 21 feet wide, and 3.24 miles of shoulder oiled, varying in width from 3 to 9 feet.

On the roadway, the gravel was cast into a windrow on the side of the road, the surface trued with a blade, and the gravel thrown back by hand to cover the oil. On streets which had no gravel, and on shoulders along paving, refuse sand from the gravel pumps was spread

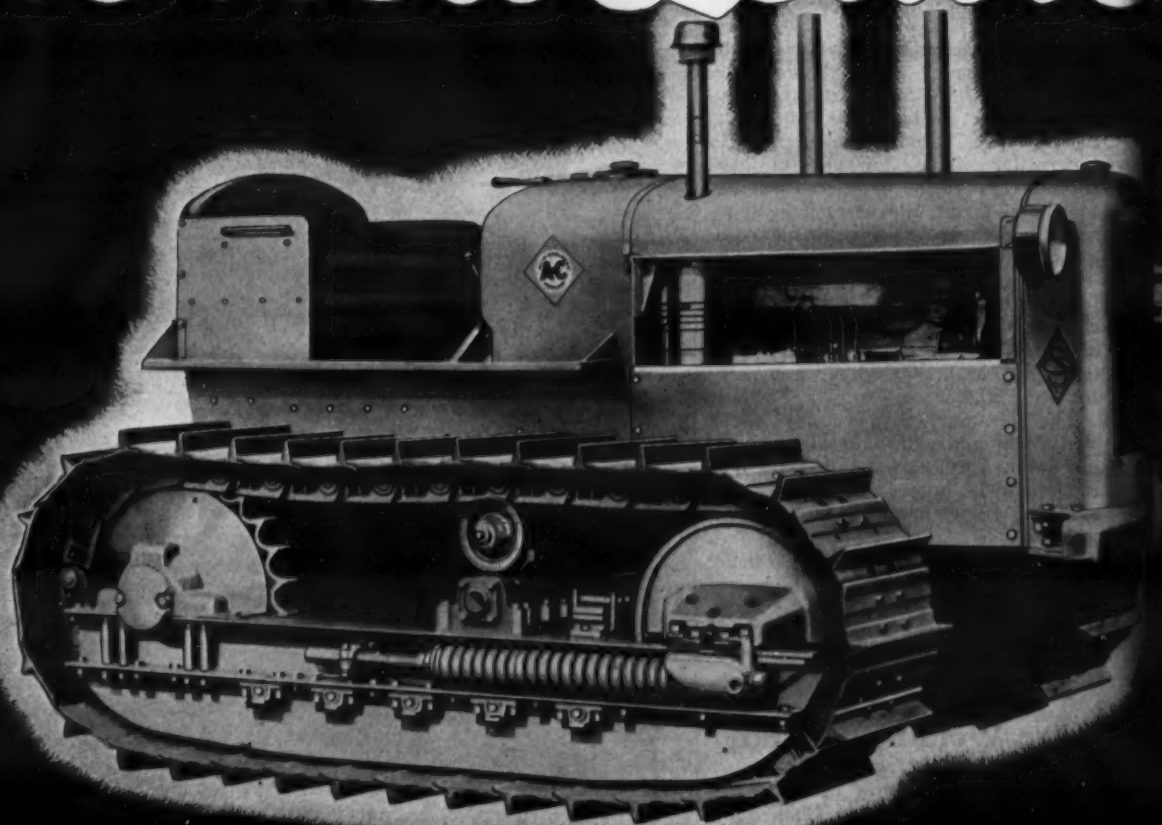
by hand at about 10 pounds per square yard. The progress of this work was $\frac{1}{2}$ -mile per day on the roadway and it took two full days to oil and cover the shoulders.

This work was carried on with a maintenance crew of ten men and one foreman with a 3-ton truck, one Caterpillar Thirty and a blade, and an oil distributor. All farm entrance culverts and ditch checks were cleaned out by hand.

Itemized Costs

Daily Equipment Costs	
1 oil truck, \$5.00 per hour.....	\$40.00
(includes 25 gal. gas, 20 kerosene, 2 qts. oil and 2 lbs. grease.)	
1 Sand truck (inc. gas, oil & grease).....	12.80
1 Caterpillar Thirty.....	13.60
1 8-foot blade.....	4.80
Cost of equipment—County owned.....	\$71.20
Daily Labor Costs	
1 Foreman	\$ 5.00

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PULLS 10-YARD TRACK WAGON

- CONTROLLED IGNITION
- FIVE SPEEDS FORWARD; ONE REVERSE
- DIESEL FUEL OIL ECONOMY
- CONSTANT MESH TRANSMISSION
- TRUCK-TYPE GEAR SHIFT
- ROLLER BEARING TRACKS
- CONTROLLED TRACK ALIGNMENT
- MORE POWER PER POUND
- INSTANT STARTING
- UP TO 6.37 MILES AN HOUR



2 Truck drivers @ \$4.20.....	8.40
1 Nozzle man	4.20
8 Laborers @ \$4.00.....	32.00
	\$49.60
Total Expense per day \$120.80 or \$241.60 per Mile.	
Oil Used (Season of 1936-1937)	
Road oil	77,871 gals.
MC-2 oil for shoulders.....	2,300 gals.
Total gallons of road oil.....	80,171 gals.
Total cost of oil, @ 6c per gal.....	\$4,810.26
Road oiled, 20.65 miles (12,320 square yards per mile).....	254,408 sq. yds.
Shoulder oiled	11,150 sq. yds.
Total area oiled.....	265,558 sq. yds.
Summary of Total Costs	
Labor on road, 42 days.....	\$ 2,083.20
Labor on shoulder, 2 days.....	99.20
Equipment on road.....	2,990.40
Equipment on shoulder.....	142.40
Oil cost, road.....	4,672.26
Oil cost, shoulder.....	138.00
Total	\$10,125.46
Unit Costs, 265,558 square yards oiled \$.038 per sq. yd.	

Pedestrian Foot Paths

Referring to another problem, that of

traffic safety, we have begun, with the assistance of WPA, the initial portion of a project which will provide foot paths along paved county highways tributary to schools and bus stations in outlying districts. One and one-half miles on West Q Street serving Ashland Park, America's largest rural school, has been completed.

This initial portion comprises 15 miles of 3-foot bituminous-filled slab placed 2 to 4 feet from the pavement edge, and of 5-inch thickness to bear encroaching wheel loads without damage to the foot path.

It is believed that these foot paths will eliminate accidents and fatalities such as have heretofore so frequently occurred when pedestrians are forced to use highways for sidewalks.

Minnesota Lights Highways

Experimental steps possibly presaging a program of illuminating heavily-traveled trunk highways, as a means of reducing night traffic fatalities, have been taken by the Minnesota Highway Department.

Thirty-four G-E sodium safety lamps are in operation on Route 7 between Excelsior and Minneapolis, and the highway department is making a second installation on a one-mile stretch near Bemidji.

"There will always be a legitimate demand for new construction on the American road system. Highways either grow better or worse. They can not stand still with 25,000,000 vehicles in daily operation."

Pouring Two-Course Paving in New York

(Continued from page 1)

consisted of plowing out the old shoulder beside the 16-foot pavement for the new widening slab. For this purpose a Trojan plow, made especially for working against a concrete pavement, was used. The area was plowed out to 8 inches below subgrade and backfilled with gravel which was rolled with a 12-ton Acme power roller. The plow was pulled by a Caterpillar Sixty tractor equipped with a LaPlant-Choate bulldozer which also smoothed out the piles of gravel dumped by the trucks. Fine grade was prepared with a Caterpillar power grader.

A master formsetter with two assistants worked on each line of forms with the help of four laborers who prepared the form trench. A total of six men worked on the fine grade with scratch-board and shovels and was followed by a Buffalo-Springfield 5-ton power roller.

Two Pavers

The contractor used two Rex 27E pavers on this job. The first with a 30-foot boom ran between the forms and poured the 4, 5 and 6-inch base course. The second paver ran on the shoulder when pouring the 2-inch top course on the first strip and for pouring the second strip it ran on the completed first strip. The second paver, when running on completed pavement, had canvas strips placed under the crawlers to prevent marring the pavement. Naturally the batch weights had to be watched carefully and the truck drivers instructed whether they were hauling base course or top course so that they would deliver their loads to the right paver. There was one man at each paver to dump the batches and he used a scraper to prevent cement sticking to the body of the truck. Due to dry weather one man was kept just ahead of the paver sprinkling the grade and also using an insecticide sprayer for applying oil to the forms.

Working behind the first paver were two puddlers and one man operating the first Ord finishing machine which was equipped with a drop plate and used solely for striking off the concrete 2 inches below the top. A tray on the back of the finisher was used to carry extra rubber boots, shovels, lunch boxes and the 2-foot by 1/2-inch deformed round shear bars which were placed every 2 feet across the edge of the old pavement where that was being resurfaced. These shear bars were placed by the two men who spaded the sides and who placed the 15-foot bar mats. Extra heavy bar mats were used on both sides of expansion joints. Two puddlers and a standard Ord finisher with an operator followed the second paver.

The finishing operations were done by two men. These men first used a 16-foot longitudinal float which was merely used as a transverse drag from one side of the pavement to the other. They followed this with 10-foot aluminum straight-edges used as drag straight-edges. They also used a 12-inch plywood float which was run down the forms as a final finish before they edged the pavement.

The final finishing was done by one man farther back who did the final edging and pulled the caps from the expansion joints which were spaced 89 feet 6 inches apart. He also used a double broom for the broom finish, which permitted him to speed up this work.

Expansion Joints

The expansion joints consisted of 1-inch premoulded Flexcell material, an asphalt impregnated Celotex. Ten joint supports, which look like miniature shovels and which were used quite extensively last year in New York, were attached to the premoulded material with nuts and screws, five on each side. The shovel

(Continued on page 29)

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CONTROLLED IGNITION OIL TRACTOR

TO MEET THE NEED for a fast, flexible tractor in this particular power class... Allis-Chalmers presents the sturdy, fast-stepping Model "S-O." An entirely new tractor—new engine, new transmission, new tracks—all designed to work together; all built to fit the job. Handles 7 to 8-yard scrapers, 12-foot blade grader or 10-yard track wagon. New Constant-Mesh Transmission—you shift gears with the tractor in motion. Five speeds forward—up to 6.37 miles an hour. Operates on low cost Diesel fuel oil—with the exclusive A-C advantage of Controlled Ignition—one of the greatest tractor improvements in years. The "S-O" brings a new kind of tractor performance to its size and price class.

OR 12-FOOT ALLIS-CHALMERS BLADE GRADER

HANDLES 7 TO 8-YARD SCRAPERS



ALLIS-CHALMERS

TRACTOR DIVISION—MILWAUKEE, U. S. A.

Controlled Ignition

OIL TRACTORS

Grading and Bridge Jobs in Illinois

(Continued from page 2)

terial was dumped and then spread in 6-inch lifts, loose measurement, sprinkled and rolled. On the west end, the contractor used a pneumatic-tired multi-wheel roller pulled by an Allis-Chalmers Model K tractor. The ditches and back-slopes were cut with three Adams graders and a Caterpillar grader, all with 12-foot blades. The fills were completed with 3 to 1 slopes and with the same slopes for back-slopes. A 6-foot radius on the bottom of all ditches was secured by the use of a special wood drag built by the contractor and pulled by a pair of horses.

The top of the grade was 43 feet 6 inches, gutter section, and 45 feet wide and to provide for the material that will be needed for shoulder when this highway is paved, the 43-foot 6-inch section was given a 16½-inch crown in cut and 18-inch crown in fill and the 45-foot section a 16-inch crown. The material cored out for the completion of the fine grade will thus give sufficient material for the shoulder on either side of the final pavement.

The grading contract also required the paving of 7,000 feet of ditch 6 feet wide and on a 6-foot radius with concrete 4 inches thick. Open expansion joints were left in the ditch paving every 100 feet.

The grading contract was run with two 6-hour shifts and the bridge contracts with one 8-hour shift. Both contracts had the maximum labor rule of 130 hours work per month for any one employee. The contracts were divided into one award of \$87,700 for grading and \$80,000 for the three bridge structures. The grading contract called for the use of 61,480 man-hours of labor but the contractor had no trouble in absorbing it in grubbing the right-of-way and back-sloping.

The 5-Span Bridge

The contract for the 5-span continuous slab and girder bridge and for a similar 3-span bridge was awarded to Porter McCully Construction Co. of Lexington, Ill., and the award for the remaining 3-span bridge went to the Sullivan Concrete Works, Sullivan, Ill. All bridges have a 24-foot roadway and no side-walks.

The 5-span bridge has a 50-foot span at each end and three center spans of 63 feet each. The piers were carried on a foundation of timber piles driven 25 feet into a good gravel. The final pour on this bridge was of 370 yards for the floor and continuous girders which required about 30 hours, using a 2-bag Rex and a 1-bag Jaeger mixer. In order to insure sufficient light for the work which was started as early in the morning as possible and continued on through the night the contractor installed a Delco

light plant for floodlights.

Pouring the Piers

The piers were surrounded with steel sheet piling and then after the timber piles had been driven with a wooden A-frame derrick and drop hammer, the cofferdam was pumped dry with a 6-inch centrifugal pump. As soon as the seal was poured the water dropped so much that a 4-inch self-priming centrifugal, working only intermittently, was able to handle the water.

The forms for the piers were built up with 1 x 10 and 1 x 12-inch lumber, 2 x 6-inch studs and 2 x 6-inch double wales. Three rows of 6 x 8-inch wales were used at the bottom. All the forms were tied with ¾-inch rods with set screws and lug form ties. Considerable trouble was experienced with the first concrete poured on any one level due to the loss of grout caused by the forms shrinking from the heat. The forms were built with particular care and seemed tight when built but the time elapsing between completion of the

forms and the actual pouring of the concrete permitted the excessive heat of day or night to shrink the forms, leaving slight spaces between the lumber for the grout to seep through. As soon as the first grout wet the cracks the forms sealed up tight again.

When pouring the piers only the one-bag mixer was used with a 60-second mixing time. The aggregates were stock-piled close to the mixer on the bank of the stream. Two men shoveled gravel while one man wheeled the wheelbarrows to the Johnson wheelbarrow scales and to the mixer. On sand there was a man to shovel and another to wheel. From the mixer there were two buggies with a man for each and another to help push the buggies up the slight incline to the forms. The runway was made of pairs of the steel sheet piling laid across temporary light trestles. All concrete was completely vibrated in the forms with a White vibrator driven by a Lauson gas engine.

Personnel

The grading contract of F. C. Feutz of

Paris, Ill., was in charge of Robert Burris. The bridge contract of Porter McCully Construction Co. of Lexington, Ill., was in charge of Harry Calder as Superintendent, and the contract of Sullivan Concrete Works of Sullivan, Ill., was run by Paul Harschman as Superintendent. For the Illinois Division of Highways the work was under the direction of S. E. Winks, Resident Engineer.

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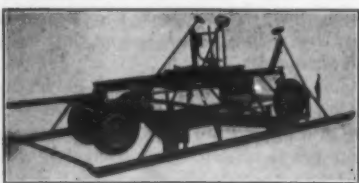
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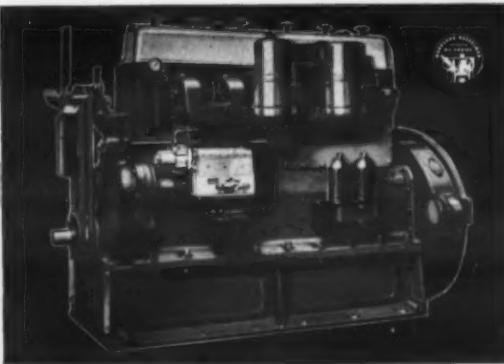


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Distributors and Salesmen
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WAUKESHA ENGINES

Pouring Two-Course Paving in New York

(Continued from page 27)

section beneath the joints was covered with a sheet metal cap which protruded about 2 inches to permit expansion of the supports.

The bottom of the expansion joint was notched to receive the shovel section or foot of the joint support. This notching was done in a novel manner. A template consisting of a series of 4-inch adjustable plates was mounted on the form at the location of the expansion joint and the plates tapped until they conformed to the grade. This was necessary because of the varying depth of concrete on this contract. Each plate had a small sharp wedge welded to it at the proper height from the bottom of the plate and after the plate had been set to the grade, the bolts were tightened, the template was lifted off and placed on a piece of pre-moulded expansion material and the plates hammered so that the wedges would cut the notches for the joint supports.

This job was run with a 1 1/4-minute mix in each paver with a single shift working 8 hours a day and, in accordance with state regulations, not more than 40 hours per week. Due to the road being open to traffic throughout the work, the speed of operations was somewhat slowed down. The early average of the job was 1,523 feet of 10-foot strips of variable thicknesses in 8 hours which was later stepped up to 1,700 feet and toward the end of the job several days at 1,900 feet were secured.

Curing and Water Supply

Curing was by the Hunt process with the drums of blended asphalt mounted on a hand truck with a gasoline motor and pump attached so that one man could readily spray the pavement and move the outfit ahead. One man was kept busy throughout the pouring of the second and third strips sweeping concrete from the pavement so that the flat wheel of the finishing machine running on the pavement would not give an uneven surface to the first strike-off or to the two screeds of the second finishing machine.

The pavement with the asphalt cure was barricaded by the use of steel forms set along the edge with an occasional form set transversely across the pavement. At intervals of about 200 feet signs were placed along the section being cured reading:

FRESH CONCRETE

Do Not Drive on This Side

Heavy wood wedges made of 8 x 8's cut diagonally were set along the edge of the pavement to permit trucks to run off the second slab onto the grade to deliver



C. & E. M. Photo

**A New Broom Sweeps Clean, They Say,
But a Double Broom Marks Faster**
their batches to the paver pouring base.
The water supply for the mixers and

for sprinkling was taken from Lake Chatouqua by a Barnes triplex pump and delivered to the job through 2 1/2 and 2-inch pipe with the valves for the paver hose spaced 500 feet apart. Each paver carried 300 feet of hose equipped with Boss and Quick-as-Wink hose and valve connections.

Personnel

This contract of J. M. Murray of Rochester, N.Y., was run by F. J. Dwyer as Superintendent. For the New York State Department of Public Works, under the direction of C. R. Waters, District Engineer, Buffalo, W. J. O'Brien was the Engineer in charge.

The contractor had his field office in a large barn on the outskirts of Jamestown. This barn was also used as a field repair shop and was big enough for a paver or a crane to be run in and overhauled. Work of this type was done during the winter of 1935-36 as this project was started late in the fall of 1935 and rough grading continued throughout most of the winter.

New Roads in Egypt

As a result of the provisions of the Anglo-Egyptian Treaty, it will be necessary for the Egyptian Government to build a number of modern roads. Three entirely new roads are to be constructed and a number of other roads are to be rebuilt into first-class military highways. The cost of this program is estimated at £5,000,000 Egyptian.

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Ideas Which Have Already Proved Helpful to Contractors



C. & E. M. Photo

The Safety Stair Treads Used on the Tygart Dam Job

Safety Stair Treads

On Construction Jobs

396 One of the first requisites on a construction job is safe ladders and stairways. If a job is to run for a whole year or longer and there are many employees moving to and fro, particularly when the shifts change, wide stairways built of heavy lumber and equipped with sturdy hand rails are necessary.

The Frederick Snare Corp., on its Tygart Dam job near Grafton, West Va., realized that with the work continuing through the winter some special protection was necessary on the stair treads to prevent slipping. Heavy rubber mats, both solid and perforated, were considered but the heavy shoes of the laborers would have quickly worn them out. The problem was solved quite successfully by securely nailing medium weight expanded metal lath to the stair treads. The sharp edges of the metal lath furnished secure footing and any ice or snow which was packed in the mesh melted quite rapidly because of the absorption of heat from the sun by the metal.

Although the mesh wore out on some steps this non-skid tread proved successful and it was easy and inexpensive to replace it in the few places it wore out.

Securing Tough Spot Pictures

397 Often, in the course of the repair of a bridge, roof truss or other structure, it is desired to secure photographs of affected parts to permit office study of the trouble.

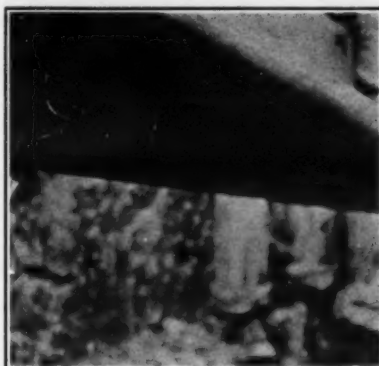
Failures frequently occur in restricted spaces where light for photography is lacking, or are in deep shadow while adjacent parts are brightly sunlit. In such a case it is possible, if electric welding be employed on the job, to take a tip from a recent pipeline overhauling

experience.

Here the pipe, an 8-inch line carrying crude oil, was found to have corroded so badly on its lower semi-circumference that a "half-sole" of 9 5/8-inch casing was welded over the entire lower half to seal the pits.

In order to secure a photograph of this pipe's condition, the engineer who doubled as field photographer found himself confronted with an open trench, flooded with brilliant sunlight from above, but with the lower half of the pipe—the part to be shown—in black shadow.

A flashlight picture might have served, had the line been covered over with a temporary shelter to exclude sunlight, but instead of going to all this trouble, the engineer had the negative pole of the welding cable tacked to the line pipe



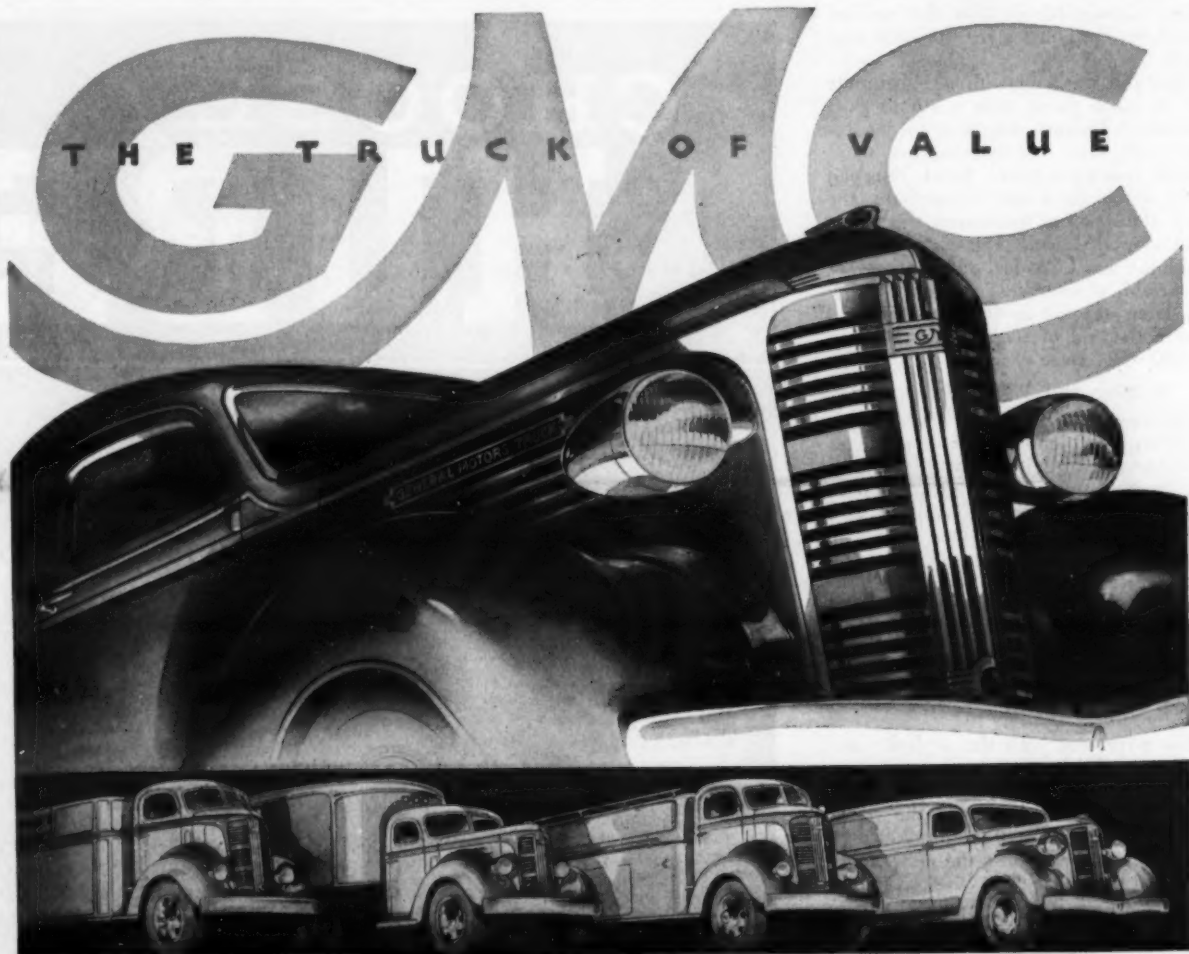
The Underside of a Pipe Photographed with Light from a Welder's Arc Against the Bright Glare of the Sun

just behind the niche cut in the trench wall to support the camera, a folding 3-A Kodak with a portrait lens slipped over the usual lens, and with lens and shutter set as for an ordinary snapshot, an arc was struck by the welder on the lower side of the pipe just out of the lens angle. When the arc had steadied, the

shutter was clicked, with entirely satisfactory results, as is shown by the accompanying photograph.

Hard-Facing Skid Chains

389 In a comparative test of truck skid chains last winter, a large trucking concern in New York hard-faced the links of one set of chains with a tungsten carbide diamond substitute hard-facing alloy. After running 265 miles, the steel chains on one tire were worn absolutely flat—almost to the breaking point. At the same time, the hard-faced chains were only slightly flattened on the surface of the drop of hard-facing alloy on each link. Actually the steel on the inner side of the links of the hard-faced chains was more worn from the tire than the hard-faced portion was from the concrete. The excellent service obtained with hard-faced skid chains was made all the more satisfactory to the owners by the fact that hard-facing cost them but a small fraction of the price of new chains.



Announcing for 1937 . . . A new and

complete line of GMC trucks . . . Advanced stream-styling that sets a new standard . . . New Cab-Over-Engine models ranging in capacity up to 12 tons and including the lowest priced 1 1/2 ton of this type now offered . . . New 1/2-tons in both 126-inch and 112-inch wheelbases, the latter priced at only \$395, chassis f. o. b. Pontiac . . . Improvements and refinements throughout the entire line . . . In every capacity range an exceptional value. **\$395 AND UP**

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EDBLUTE MANUFACTURING CO.
REYNOLDSVILLE, PENNA.

International Road Congress Will Meet Next in Holland

The Eighth International Road Congress will be held at The Hague, Holland, in 1938, according to a report of the recent meeting of the Executive Committee of the Permanent International Association of Road Congresses. W. C. C. Gelnick, Dutch Representative, gave some of the provisional plans for the meeting which will include some sessions at Scheveningen, a seaside resort which forms a part of the municipality

of The Hague, where it is expected that a road exhibition will be held. The dates selected for the Congress are June 19 to July 2.

The provisional program comprises one week for the business meetings and short excursions, and a second week for the whole day excursions, which will include visits to Amsterdam, the Zuyderzee Works, Haarlem, Utrecht, Arnhem, Dordrecht and to the southwest part of the country.

In addition to the usual questions of the materials and methods for construc-

tion and maintenance of the various types of roads, the subjects of traffic accidents and their prevention, highway lighting, and subsoils will be discussed.

Sodium Vapor Lights for South American Highway

The concrete highway between Lima and Callao, Peru, was completely illuminated with sodium light by November 15, in time for the presidential inauguration which took place soon after.

The Peruvian Government has installed 140 10,000-lumen General Electric sodium luminaires to replace the early parabolic nested highway lighting units placed in service a number of years ago. The entire installation will be turned on and off automatically by photoelectric equipment.

This is the second large foreign installation of sodium luminaires, as 150 G-E sodium units are being used to illuminate all the main thoroughfares to the British Empire Exposition at Johannesburg, South Africa.

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TARVIA PAVEMENT
IS SKID - SAFE...
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Variety of Work On Cape Cod Canal

(Continued from page 14)

weighing 42.7 pounds per foot and measuring 43 feet in length, into leads held by a P & H portable crane. The sheet piling was driven close to ground level by a Vulcan 5-ton steam hammer operated from a portable steam boiler located nearby. A special electric-steel casting grooved to fit the piling was used as a driving head.

A wale, consisting of two 8-inch channels back to back with a 3-inch pipe spacer, was attached to the piles at an elevation of 2 feet above mean low water. A Link-Belt dragline with a 2-yard Page bucket excavated behind the sheet piling for the anchorage. Wood piles spaced 6 feet 8 inches apart were driven approximately 42 feet back of the sheet piling for the anchorage. Two tie rods, 2 inches in diameter, one 15 feet 4 inches long connected by a turnbuckle to one 29 feet 10 inches long, furnished the tie to a continuous 2-foot x 4-foot reinforced concrete beam which ran behind the timber piles.

Perini's 2,200,000-Yard Contract

On its 2,200,000 cubic yard contract between Stations 150 and 320 on the south side of the canal, B. Perini & Sons, Inc., is carrying on a difficult operation for this type of work. Having started excavation from the 20-foot dike at the edge of the present canal, Perini put in a large amount of excavating equipment and was soon below ground water and high water level in the canal. This required the installation of four 6-inch Carter Humdinger pumps and one 8-inch Moretrench pump to keep the excavation dry. A large number of boulders, amounting in total to about 23,000 cubic yards, was met in this section so a Schramm 310 compressor mounted on a Sterling truck was used to furnish power for Ingersoll-Rand jackhammers to drill the large boulders for block-holing. Excavation was carried on by a Northwest dragline swinging a 3-yard Northwest bucket. This was not very successful because the boulders, ranging from $\frac{1}{2}$ to 5 cubic yards in size, were altogether too numerous to permit the dragline bucket to do its usual effective work. The largest boulder was 90 cubic yards.

Two Lorain 77 diesel shovels are working on the excavation, loading the smaller boulders with the sand and gravel to a fleet of nine Euclid 8-yard Trac-Truks and six 12-ton Mack trucks owned by the contractor and eight 8-ton Macks hired locally. The contractor has excavated an average of 1,000 cubic yards per 10-hour day per shovel.

The boulder problem was solved in three ways. First by blasting as mentioned above, second by loading into the Trac-Truks with a Northwest crane

swinging an Owen rock grapple and third by an unusual arrangement with another contractor. The Cape Cod Construction Co. of Falmouth, Mass., has the contract for the construction of a breakwater at Falmouth, Mass., in lower Buzzards Bay, for which large stone is required. It made an arrangement with Perini to remove boulders from his contract, thus helping to clear the area of this more troublesome type of excavation. A Lorain 40 and clamshell was installed by the Cape Cod Construction Co. for this work, loading to its own trucks.

A hauling road through the excavated area and up the bank as well as on the enormous spoil pile created south of the new highway is maintained in good shape by an Allis-Chalmers 75 with a Baker bulldozer. It also assists in boosting boulders around when they are in the way of the shovels. Perini also uses a Caterpillar Ninety diesel with a LeTourneau bulldozer, a Caterpillar Seventy-Five diesel with a Carryall scraper and a Caterpillar Seventy-Five diesel



C. & E. M. Photo

Most of the Large Boulders Were Quickly Removed by a Heavy Rock Grapple

with a LeTourneau bulldozer, grading the spoil bank. Another Caterpillar Fifty diesel and bulldozer is kept as a

utility unit doing many odd jobs.

J. L. Ryan is Superintendent for B. Perini & Sons on this contract.

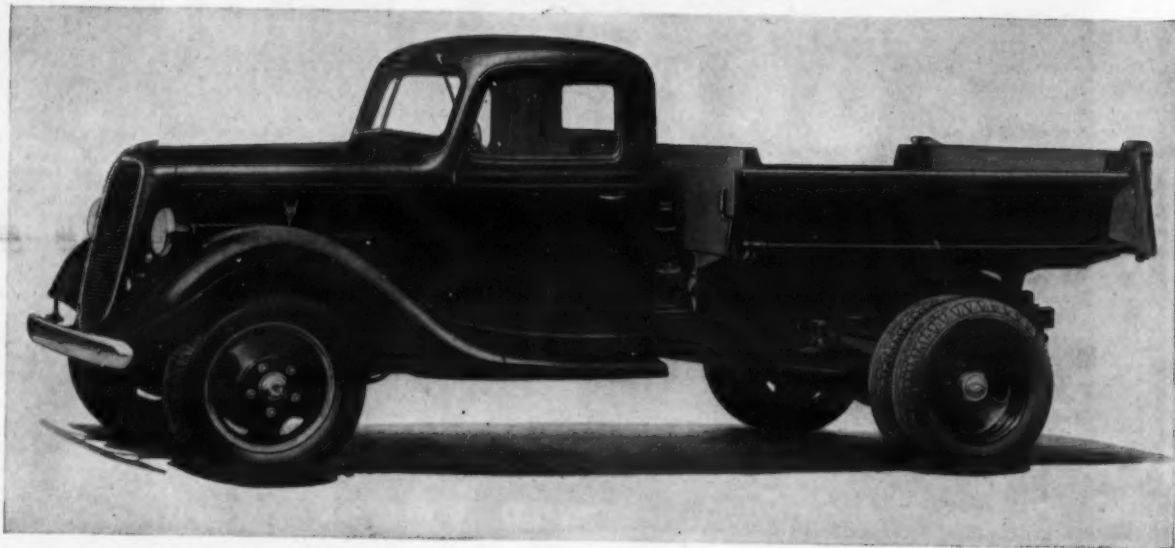
New Channel for Scusset River

The Scusset River is a small meandering stream originating in the salt marshes on the north side of the canal at the east end. Overflow from Indian Spring as well as drainage from the surrounding area are the sources of this small tidal stream. The Scusset River has a truly nomadic background for, in flowing through the sand dunes to Cape Cod Bay, the mouth of the stream has moved up and down the coast over a distance of a mile during its 300 years of known history. Its migrations are a threat to the breakwater at the east end of the canal because should the mouth of the stream eat its way across the narrow stretch of dunes at the shore end of the breakwater, rapid filling of the canal channel would result.

To eliminate the possibility of dam-

(Continued on following page)

FORD SHOWS THE WAY TO LOWER MATERIAL HAULING COSTS



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Canal Job Requires Heavy Equipment

(Continued from preceding page)

age by the Scusset River, a new relief channel has been prepared to carry flood waters directly into the canal through an open ditch and 160 feet of 48-inch reinforced concrete pipe. This work was included in the contract of A. G. Tomasello & Sons of Boston between Stations 10 and 70 on the north side of the canal.

Excavation was handled with a Lorain dragline and 1 1/4-yard Page bucket and a Lorain 1 1/4-yard backhoe. The open ditch measured 4 feet at the bottom with 2 on 1 slopes on either side. It was excavated to an average depth of 5 1/2 feet.

The crushed stone revetment on the open ditch was placed with a Lorain crane and 3/4-yard Owen clamshell. A Speedcrane swinging a stone skip handled the heavy material for the upper riprap. The crushed stone was spread in a 6-inch layer and the riprap 12 inches thick on the bottom and slope of the channel.

Service Road

To insure maintenance of the riprap along both banks of the canal, a service road is being constructed on each bank for the full length of the canal. This road is 18 feet wide on a 20-foot berm and is being paved with 3 inches of penetration macadam. Patrol trucks and heavy trucks hauling riprap for repair will use these roads which will not be open to the public.

Labor, Costs and Quantities

The widening of the Cape Cod Canal is being carried on with funds provided by three acts of Congress: first, the recent River and Harbor Act which permits an 8-hour day; and second, monies from the PWA allotted to this work and permitting labor to work 140 hours per month, 40 hours a week, but not more than 8 hours in any one day; and third, monies from the ERA 1935 Act, permitting labor to work not more than 130 hours a month.

Comparative costs of excavation by the various methods used in the widening of the canal are of interest. Bids on excavation in the dry have varied from 20 to 25 cents per cubic yard; bucket dredging with floating equipment from 30 to 40 cents per cubic yard and suction dredging from 14 to 16 cents per cubic yard. Inasmuch as excavation in the dry permitted a larger area to be excavated at one time and with less interference with shipping than the less expensive suction dredging, that method

FASTER DIGGING MULTIPLE-ROPE BUCKET.

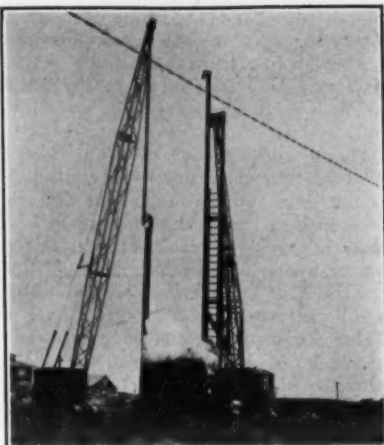
The Williams Multiple-Rope Bucket has a double hinge which not only allows for a longer spread of the open bucket, but makes for a more rigid construction—greater digging power and speed.



Williams Buckets are built in Power-Arm, Power-Wheel, Multiple-Rope and Dragline types. Write for new bulletins.

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**WILLIAMS
BUCKETS**



C. & E. M. Photo

It's a Ticklish Job to Thread Two 43-Foot Lengths of Steel Sheet Piling But Here It's Being Done at the Bulkhead for the New Fish Pier

was resorted to for most of the work. The clean-up of the dikes is being done entirely by bucket and suction dredges

and the major work in deepening the channel in Buzzards Bay is being handled entirely by a fleet of suction dredges.

The approximate quantities and costs of dry excavation and revetment as well as the dipper and hydraulic dredging on special sections are given in the accompanying table.

Stations	Tons Crushed Rock	Tons Riprap	Cubic Yards Excavation	Costs
10+50-28+50 } North	8,550	23,673	53,700	\$ 99,544
and 45-70 }				
70-150 North	15,500	38,300	358,100	227,625
150-255 North	17,900	40,000	1,450,000	483,000
255-325 North	15,910	28,040	147,700	150,751
325-391 North	8,857	17,736	190,125	123,878
9-18 and 36-78 South	8,500	19,900	201,300	115,913
78-150 South	10,900	36,600	1,050,000	365,690
150-320 South	29,075	56,925	2,409,050	787,047
320-371 South	9,491	17,849	218,298	126,438
371-387+50 South	2,324	5,224	70,223	34,802
Grand Total	127,007	274,147	6,048,698	\$2,514,688
10-36 South	Steel Sheet Pile Bulkhead—1,900 ft. of sheet piling.....			\$123,584.30
Hog Island Channel				
Dipper Dredging 32 ft. deep x 150 ft. wide.....	{2,000,615 cu. yds.....			\$801,392
Hydraulic Dredging 32 ft. deep x 350 wide.....	{2,115,111 cu. yds.....			905,706
	{4,428,400 cu. yds.....			697,000
East Mooring Basin				
Hydraulic Dredging 25 ft. deep x 3,300 ft. long.....	1,212,500 cu. yds.....			\$150,593
Cape Cod Canal				
Dredging and Pier Removal.....	199,004 cu. yds.....			\$ 147,961
Widening to 205 ft. width, 25 ft. depth.....	2,946,749 cu. yds.....			1,195,927
Widening to 315 ft. width, 32 ft. depth.....	8,990,100 cu. yds.....			3,040,661

Personnel

The various contracts for the improvement of the Cape Cod Canal are under the direction of the U. S. Engineer Department, Col. A. K. B. Lyman, District Engineer, and Capt. H. J. Casey, Corps of Engineers Executive, Boston, with H. N. Crichton, Principal Engineer with offices at Buzzards Bay.

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Wherever Needed

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The compressor unit is built to the same precision standards as the regular LeRoi-Rix Air Compressors, portable and stationary types—noted for better cooling, lower operating costs, longer life... Write for complete information.

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Conducting Business For Tax Advantage

Status as Independent Contractor Is Important In Determination of Payroll Taxes

By WILLIAM H. CROW
Tax Attorney and Co-Author of "Planning
for Tax Economy"

IN the second article of this series, which appeared in the December number of CONTRACTORS AND ENGINEERS MONTHLY, it was pointed out that a contractor, in arranging for others to perform a part of the work, must be alert to avoid liability for contributions on the payroll of employees of such other persons. In the event that such other person is a subcontractor within the definition of the statute, the contractor will, under statutes like that of New York, be liable for contributions on the subcontractor's employees unless the subcontractor accepts exclusive liability therefor under an agreement with such employer, made pursuant to regulations promulgated by the Commission.

The provisions cited below from the New York Unemployment Insurance Act and regulations relating to subcontractors and independent employers are typical of corresponding sections in unemployment insurance acts in a majority of the states. In some states, although the law itself does not deal specifically with subcontractors, the regulations issued by the state body empowered to administer the act give interpretations substantially in accordance with that of the New York law and regulations. For example, in the District of Columbia the law is very brief in defining "employer" but the regulations are full and specific in respect to subcontractors and independent contractors.

Within the limits of the present article it is impossible to give an analysis of state provisions, and in any case the reader must be thoroughly familiar with the provisions of his own state law.

With respect to the provisions of Title IX of the Federal Social Security Act and the regulations issued thereunder, as distinguished from the regulations issued by state administrative bodies, it may be advisable to point out that Title IX of the federal law imposes an excise tax on employers for the privilege of employing persons, to which any employer is subject who has eight or more persons in his employ at least one day a week for twenty weeks during the taxable year. These provisions, however, do not include a federal unemployment compensation system. The purpose of the provisions is to stimulate establishment by state legislation of unemployment insurance systems. Contributions made under these state systems to unemployment compensation funds established under approved state laws are permitted a 90 per cent credit

against the tax imposed by Title IX. It will be plain that both the provisions of Title IX and the provisions of the state act must be examined to obtain guidance as to the position of the taxpayer coming within the jurisdiction of these acts.

In contra-distinction to Title IX, Title VIII is purely a federal exaction imposed for old age benefits and the states have nothing to do with the administration of the Act.

In determining whether or not a person is a subcontractor, reference must be had to the statutory definition. Under the New York law, a person who contracts with another for the performance of any work which is part of the latter's usual trade, occupation, profession or business shall be presumed to be a subcontractor, if he (a) customarily does not hold himself out as ready to perform work for anyone who may wish to contract with him; or (b) performs his work on premises which he neither owns nor leases, or which he leases from one for whom he is performing work; or (c) does not furnish his own equipment or, where equipment is not an important factor in the performance of the work, does not furnish material; or (d) furnishes labor or service on a cost plus basis. Although under the New York law anyone for whom a subcontractor performs work shall be liable for contributions on the payroll of such of the subcontractor's employees who are engaged upon such work, the law also provides that a subcontractor, on furnishing evidence of financial responsibility satisfactory to the Commissioner and complying with such conditions as may be prescribed, shall be permitted to assume exclusive liability for contributions on the payroll of his employees covered by the Act, and there shall be no liability for such contributions upon anyone for

whom a subcontractor obtaining such permission performs such work.

This permission may be revoked by the Commissioner at any time that the subcontractor fails to meet the standards of financial responsibility and the conditions fixed by the Commissioner. It therefore behooves the contractor to give continuous attention to the financial responsibility of the subcontractor and to see that the conditions fixed by the Commissioner are maintained.

Employer or Subcontractor

As distinguished from a subcontractor, an independent employer under the New York Unemployment Insurance Law is defined as a person who contracts with another for the performance of any work which is part of the latter's usual trade, occupation or business, if such person (a) customarily performs work or holds himself available to perform work for anyone who may wish to contract with him; and (b) performs his work on premises which are under his own control either as owner or as lessee

(Continued on page 44)



"The whole industry will have to come to all welded construction to keep up with these P&H Pacemakers." — Frank Pakiz, shovel operator.

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The P&H Pacemakers are the first and only machines equipped with these tractor type crawlers. Here's an assembly that's built for travel—hard travel—not mere browsing. Hinge action shoes of tough heat-treated alloy steels take it over the ground with true rolling movement—with freedom from breakdowns wherever you go. This type of crawler has proved itself in literally millions of miles of tractor service . . . it's only one of the many important advancements that make these P&H Pacemakers faster on the job.

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Safety Made Possible At Grade Crossings

Few Trains But Heavy Traffic Make Protection of Traveling Public Necessary on U. S. 20 At Wayland, Mass.

THE Department of Public Works of the State of Massachusetts has recently completed the installation of an automatic barrier in the roadway on U. S. 20, a heavily-traveled thoroughfare between Worcester and Boston. This is the first installation of this type in Massachusetts and it is attracting considerable attention on the part of the motoring public as well as close inspection by rail, highway and safety officials from other states.

The device is installed on both sides of the railroad within the highway at the grade crossing of the Boston & Maine Railroad at Wayland, Mass. It automatically prevents the driver of an approaching motor vehicle from reaching the tracks when a train is approaching, while the installation and maintenance cost is not prohibitive as are many grade separation projects when financed entirely locally.

The device installed at Wayland provides an unmistakable warning of the approach of a train, even before the train is in sight, and then after allowing ample time for motorists to heed the warning, it provides a definite barrier between the motorist and the railroad which will stop a reckless driver without injury to the driver or passengers and with a minimum amount of damage to the car.

Installation

This barrier consists of a hollow frame work of cast steel within which is suspended a cast steel lid which is hinged, along the back, to and flush with the top of the frame. Underneath this lid is mounted a crankshaft with springs and connecting rods which raise and lower the lid. These sections are in 10-foot lengths and are placed across the roadway, for example, two 10-foot sections across a 20-foot road, on either side of the railroad, about 100 feet from the tracks.

The barriers are mounted in a reinforced concrete pit with the top of the lid or barrier flush with the road surface. The concrete pit is extended for 5 feet on one side of the roadway and the driving mechanism is set in this extension, flush with the road shoulder and covered with a manhole cover. The drive mechanism consists of a box-like frame of 2½-inch steel angle bars and mounted therein are a motor, brake, circuit controller and gear reducer, necessary for the operation of the barrier.

The barrier sections and drive mechanism comprise the barrier proper. In addition, however, there is a standard red and green traffic light located alongside the road opposite the location of the barrier. The green light in this traffic signal burns as long as there is no train approaching the crossing, but when a train enters the control limits, the green light goes out and the red light comes on. Approximately three seconds later the barrier starts to rise. As soon as it starts up the two lights in the face of each lid flash, corresponding to the common flasher light now in use at grade crossings.

Operation

The barrier rises to a height of 4 inches and hesitates at this warning point for a period of 10 seconds. It is held in this position by means of two torsion springs which are easily depressed by a force of 150 pounds. It is obvious that a car



The Automatic Barrier in Operation to Prevent a Grade Crossing Accident on U. S. 20 at Wayland, Mass.

whose driver refuses to regard the warning and continues over the barrier will merely depress the lid flush with the road surface and continue on over it, but while the barrier is in this position, there is still ample time for the driver to get

over the tracks before the train reaches the crossing.

At the expiration of the 10-second warning interval, at which time the train is close to the crossing, the barrier rises further to a point 9½ inches above the

roadway and locks at this point, so that it cannot be depressed. It remains in this position until the train has passed the crossing and it is safe for motorists to proceed, and then lowers itself back into the roadway where it presents no obstruction to traffic and to all purposes is merely a section of the roadway.

While this is the first installation of the Auto-Stop, made by Evans Products Co., Detroit, Mich., in Massachusetts, other installations have been in operation in Michigan, Ohio, New Hampshire, Long Island, N.Y., Tennessee, and Indiana for long periods and additional installations are under way in Michigan, Vermont and Arkansas.

Gasoline taxes were the principal source of revenue for Connecticut during the past fiscal year, according to a report of State Treasurer John S. Addis. They amounted to \$7,191,846, or about 10 per cent of the state's total revenue of \$71,781,847, and show an increase of more than \$2,000,000 over the previous year.

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LEADERS IN DRILLING EQUIPMENT

Sodium Lights Play Part In Safety on New Bridge

The new San Francisco-Oakland Bay Bridge carried an unprecedented traffic flow without an accident in the first two weeks of its operation, E. R. Cato, Chief of the California State Highway Patrol, said in a report to the General Electric engineers who designed the sodium vapor safety lighting for the bridge.

"It has been our observation that the sodium lights in use on the bridge have

practically deadened the glaring lights from approaching cars," Mr. Cato said. "To date (November 24), we have not experienced an accident on this structure, where the largest traffic volume has been handled of any locality in the state of California. The ability to see in fog, both day and night, has unquestionably reduced to a minimum the hazards attributable to low visibility."

C. H. Purcell, Chief Engineer for the San Francisco-Oakland Bay Bridge Commission, gave careful thought to every possible safety factor which could

be built into the bridge and its approaches.

Dense fog, blanketing Oakland Bay and causing delay in shipping and ferry service the morning of November 17, failed to slow the speed of traffic on the new bridge, according to the *San Francisco Examiner*. In this, their first trial against daytime fog, the sodium lights proved a success, and on the eastern span, where the fog was thickest, the lights permitted cars to move at 45 miles an hour, the paper reports.

On the Sunday following the opening

of the bridge, 100 cars a minute passed through the toll gates. Now the traffic has settled to what apparently will be the future week-day average of 35 cars a minute, according to the *San Francisco* paper.

The Seine Council of Paris has decided to borrow 300,000,000 francs and the French Government has promised to contribute a certain amount toward the cost of widening suburban roads and bridges to take care of the traffic entering and leaving Paris.



Clark Avenue, looking toward 14th Street. Old granite blocks re-surfaced with Hot Mix Asphaltic Concrete



Locust Street from Leonard Avenue. Re-surfaced with Hot Mix Asphaltic Concrete.



Eighth St. looking toward Chouteau Ave. Very rough granite block covered with Hot Mix Asphaltic Concrete using a minimum of $\frac{3}{4}$ " thickness.

How St. Louis re-surfaced 85 miles of streets with ASPHALT at LOW COST

A total of 1,800,000 square yards of pavement has been re-surfaced in St. Louis during the past three years with asphalt. That's equivalent to 85 miles of street with a 36-foot width.

In carrying out this re-surfacing program, the engineers had to consider several essential factors. First—*Economy*, due to a limited budget and the large amount of re-surfacing involved. Second—*Safety*, by providing a non-skid, non-glare surface. Third—*Durability*, under heavy traffic demands. And fourth—*Quick Application*, to avoid interference with traffic.

The Standard Oil Company (Indiana) which furnished most of the asphalt for this work, is, of course, pleased that the St. Louis Engineers approved its material and found it satisfactory in all respects.

Here is dramatic proof of the adaptability of asphalt—proof of its economy, safety, durability and quick application possibilities! Let a representative from your local Standard Oil office talk over your paving problems with you. This service is without obligation or cost—yours for the asking—and it may very readily be an economical solution to all

your paving needs. Phone at any time. Take advantage of Standard's long years of experience in every kind of paving problem.

Here's What Happened in St. Louis

A large amount of re-surfacing was placed over sheet asphalt. A special mix was used, consisting of a hot mix at 250° F. using 95% Lead Belt Chat and 5% 85-100 penetration Asphalt Cement. This averaged 60 pounds to the square yard.

In re-surfacing the granite or brick pavement the same mix was used, requiring 125 pounds per square yard. There are 16 miles of this type of pavement on Broadway.

This work was carried out under the personal direction and supervision of Frank J. McDevitt, Director of Streets and Sewers, City of St. Louis.

New surface was able to bear traffic immediately after compacting!

A survey through the bus companies and taxi cab drivers brought enthusiastic praise of three features of the re-surfaced pavement: *non-skid*, *non-glare* and *freedom from tire noise*.

About 100,000 square yards of re-surfacing was done at night from 9 PM to 4 AM. This night work was done on heavy traffic streets with portable stands, using auto headlights. The record for re-surfacing in one night was 2500 square yards, using 12 men.

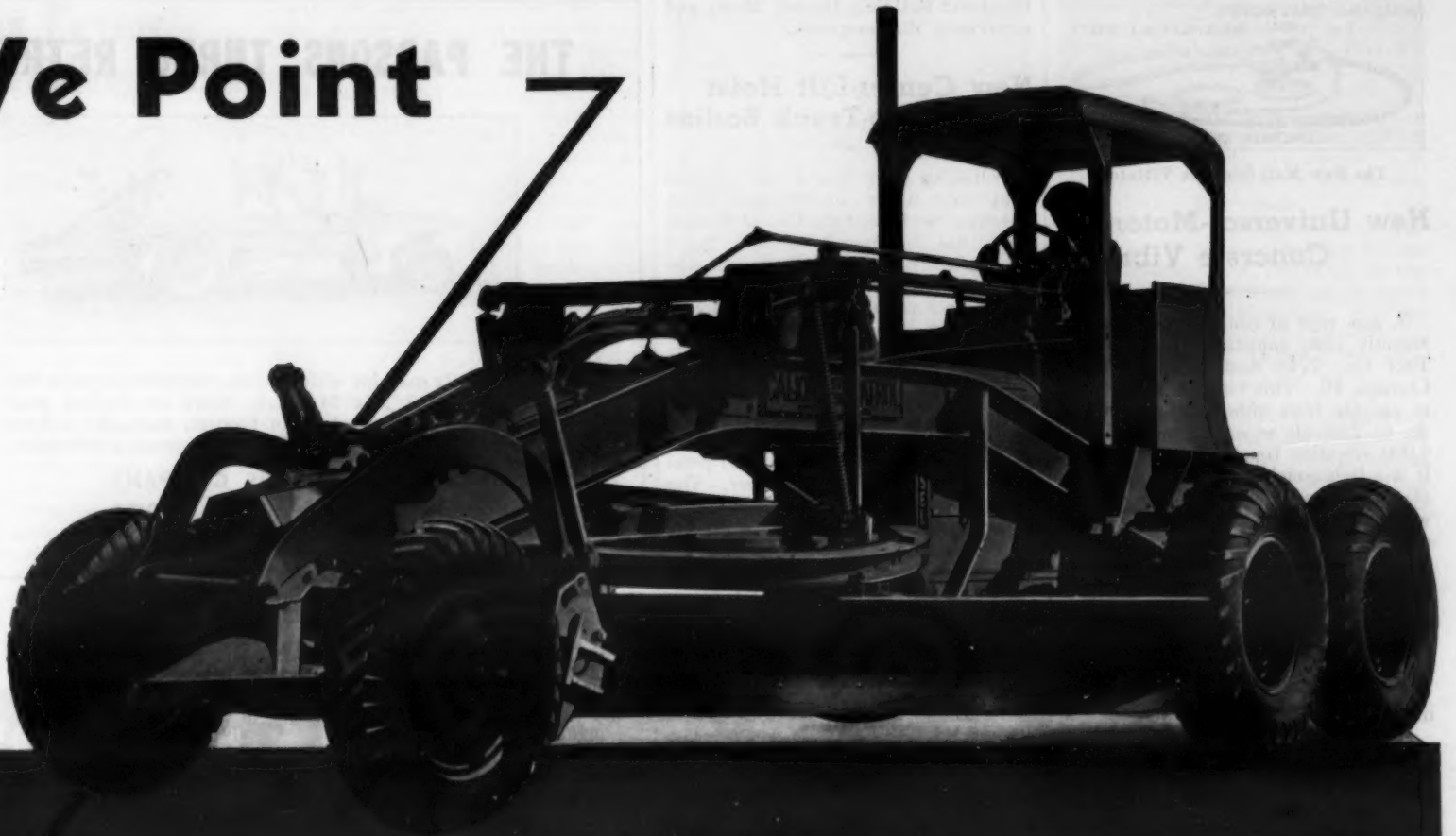
No seal coat was used on any of this work.

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Into this Master Diesel Motor Grader is fused the perfected one-man Grader design, tested by many years' experience and dependable service, with an outstanding modern Diesel power unit . . . McCormick-Deering Model TD 40 Diesel Engine. Already it is making splendid records of economy in fuel consumption.

Galion has been building road machinery for 30 years . . . designs almost every type . . . some with features that cannot be obtained elsewhere. Galion Engineers have built up in those years the experience and skill . . . have the resources of devices and material . . . to throw wide open this vast source.

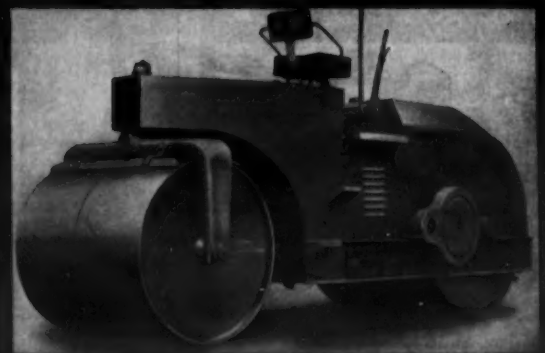
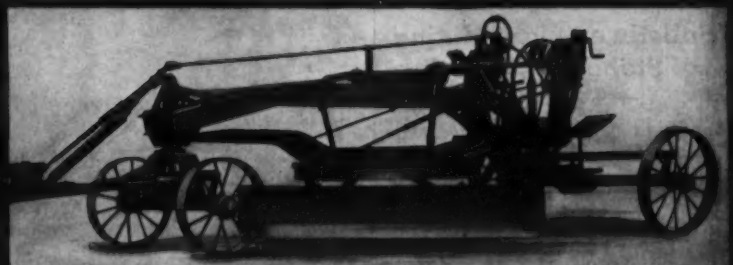
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DO YOU KNOW
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The New Mall Concrete Vibrator

New Universal-Motor Concrete Vibrator

A new type of concrete vibrator has recently been announced by the Mall Tool Co., 7743 South Chicago Ave., Chicago, Ill. This vibrator is designed to operate from either 110-volt, ac or dc, or 220-volt ac or dc, and delivers 9,000 vibration frequencies per minute. It is a light-weight unit, the power unit of which can be carried in one hand while the vibrator is operated by the other.

Mall universal motors are designed and manufactured to deliver the maximum horsepower to the job of compacting the concrete. These motors are equipped with a special heat control to prevent burn-outs. An oil filter is provided to exclude dirt and other foreign material.

A feature of this vibrator is the use of a steel reinforced high-specific-gravity off-balance lead weight revolving on double ball bearings inside of a totally enclosed steel protecting shell, permitting the vibrator to compact the concrete quickly and efficiently.

New Bulletin on Plant Mixing of Stabilized Materials

"Plant Mixing Stabilized Aggregates with Calcium Chloride" is the title of a new Bulletin, No. 34, of the Calcium Chloride Association.

Recent developments in plant-mixing are discussed, and information is given on equipment, preparation of materials, mixing procedure, and the function of calcium chloride as the admixture. Among the bulletin's many illustrations are photographs of several stabilized-mixture plants and a diagram of a gravity flow stabilized-aggregates plant.

A copy of Bulletin No. 34 may be had, without charge, by writing to the Calcium Chloride Association, 4145

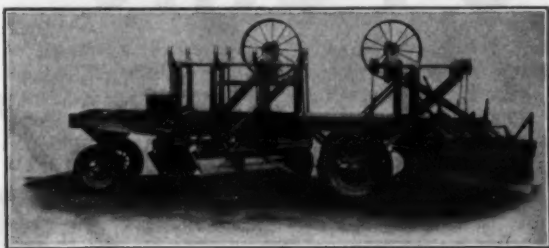
Penobscot Building, Detroit, Mich., and mentioning this magazine.

New Center-Lift Hoist for Dump-Truck Bodies

Following more than a year of rigid field tests under adverse conditions, Hercules Steel Products Co., of Galion, Ohio, has announced its new Super Power Center-Lift hydraulic hoist. The hoist was designed by Fred Bisantz who has over 25 years' experience on hoists, dump bodies and other mechanical equipment.

The new hoist applies the lifting pressure at the center of the body, using two arms which does away with the danger of cramping. It is reported that the center lift requires a very low oil pressure and minimum lifting power. The cylinder is seamless steel finished to a glass smoothness. A heavy-gage welded steel sub-frame is used and there is no concentration of the load at one point.

THE PARSONS TURBO RETREAD



The only machine which mixes, windrows, spreads and edges Road Mix Materials. Used by leading road builders for every kind of binders, road oils, cutback asphalts, emulsions, calcium and cement stabilization.

THE PARSONS COMPANY
NEWTON, IOWA.

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100%

AUTOMATIC PRIMING

Sterling's patented construction and double priming action assures rapid priming on 25-foot suction lifts.

Re-circulation is controlled without use of flapper valves or gadgets.

Write or ask for literature.

Sterling
Machinery Corporation
Southfield, Mich.

Hot-Mix Paving On Mountain Road

(Continued from page 1)

specifications as to sizes varied greatly. To furnish such sizes as had to be added, the contractor used a Cedar Rapids 3 x 36-inch crusher driven by a 40-hp Allis-Chalmers electric motor. The crusher was set up alongside the Madsen No. 44 asphalt plant and took the oversize from the conical screens.

The original aggregate production plant consisted of a Lorain 75 1/4-yard gas shovel working in the pit and delivering material to three Ford shuttle trucks. The gravel and sand were delivered to a 12-inch grizzly, then to a single-deck Traylor vibrating screen which wasted all stone under 1 1/4-inch in size, and thence to a 15x36 Universal crusher which broke it down to 2 1/2-inch pieces. Then it was delivered to an elevator and then to a 3-deck Simplicity vibrating screen and was separated into four sizes. The oversize gravitated to a 3-foot Symons cone crusher which broke it down to smaller than minus 3/4-inch and returned it to the vibrating screen. This was the material used for the 1936 surfacing contract.

The material from the old stockpile was hauled about 3/4 mile to a circular stockpile alongside the asphalt plant where the various sizes were well mixed by three 2-horse fresnos. The fresnos also moved the aggregates to the hopper above the reciprocating feeder for the bucket elevator which carried the material to the top of the Madsen plant where the drier is located.

The Asphalt Plant

From the drier the aggregates ran back over the screen giving a double passage through the hot gases of the drier. The drier sloped to the right as one faced the plant, the conical screen sloped back to the left and the gases were passed through the drier and released to the screen.

The 2,000-pound mixing plant was operated 8-hour shifts for 6 days a week on this state work where 48-hour weeks were permitted. It has produced 800 tons of hot mix in 10 hours. The operating crew consisted of three men on the fresnos, one feeder man, one burner man, one mixer man, one laborer or handy man, one fireman, and a watchman. The plant was operated by a 100-hp Allis-Chalmers electric motor.

The screened dried material was stored in two bins of about 3 tons capacity each and the batches as made up for delivery to the trucks below consisted of 1,200 pounds of 3/4-inch stone and 800 pounds of 1/4-inch stone and fines with 4 1/2 per cent asphalt.

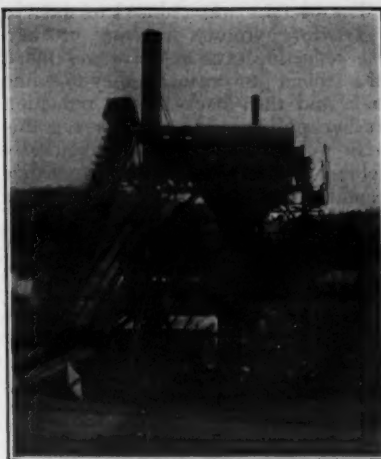
The asphalt was hauled in to the job by four trucks from a siding 30 miles away where a booster heater kept the asphalt in fluid condition. The trucks drove onto an elevated area behind the plant and delivered the asphalt to the four 5,500-gallon storage tanks by gravity. A single set of coils running through the four tanks and attached to the coal-fired boiler maintained the asphalt in condition for use in the plant. A 2-inch Morse Bros. asphalt pump was used to boost the asphalt from the storage tank to the 6,000-gallon insulated supply tank which was equipped with two sets of steam coils. A Wagner asphalt pump delivered the asphalt from the supply tank to the weigh box. The batches were produced at a temperature of 160 degrees and were given a 45-second mix in the pug mill. The drier at the top of the plant was oil-fired and the steam plant furnished heat for the coils and also for operating the gates of the plant.

Laying the Surface

The 20-foot road surface was laid with

Burch spreader boxes and then the material spread to the full width of the road with a Caterpillar No. 11 diesel grader with a 12-foot blade and a No. 44 Caterpillar 10-foot grader pulled by an International 15-30 wheel tractor. The material was laid down by the spreader boxes at a depth that, when spread to the full width of the road and rolled, would produce a 2-inch compacted surface under the rollers. The road was spread about 1,000 feet at a time and then completed before any further material was spread. The rolling was done longitudinally with a 10-ton Buffalo-Springfield tandem gas roller. Diagonal rolling was done only at the joint when needed.

The batches were hauled to the road in Ford trucks which handled four of the 2,000-pound batches per load. Each load sent to the road was weighed by a state inspector on a 37,000-pound Fairbanks-Morse platform scale near the plant. On the road one man checked the weights per station to be sure that the specifications were being adhered to. Two men were used to hook and un-



C. & E. M. Photo

The Hot-Mix Plant Set-Up

hook the spreader boxes to the trucks. On the longer hauls several White trucks, all hired, were added to the fleet. These handled six batches per load.

The surface of the hot mix was sealed

at the end of the laying with a medium curing oil, having an 80 per cent asphalt content, spread over the surface with a trailer distributor made by the contractor, at the rate of 1/6 gallon per square yard. Then a truck equipped with a Dittwiler rotating disk spreader applied 15 pounds of chips per square yard, ranging from 3/8-inch to 10-mesh in size.

Personnel

This 2.2-mile asphaltic concrete road project was awarded to Hamilton & Gleason of Denver, Colo., for \$4.00 per ton and was completed under the direction J. A. Hynds, Superintendent. For the State Highway Department the work was in charge of Daniel Ormsbee, State Engineer.

Improved methods in the refining and cracking of crude oil have enabled the petroleum industry to obtain almost twice as many gallons of gasoline from a barrel of oil as was possible in 1920. These technological advances have resulted in the reduction of the average retail price of gasoline from 29.74 cents in 1920 to only 13.55 cents in 1935.

Crushing

WET ORE

CONTAINING CLAY AND TALC

- 1 Tel-smith-Wheeling Roller Bearing Jaw Crusher.
- 2 Tel-smith Pulsator
- 3 Tel-smith Gyrasphere Crusher

To develop their Comet Mine, the Basin-Montana Tunnel Co. of Basin, Montana, after the most careful investigation, selected Tel-smith crushing equipment. Operation, begun early in 1934, has been continuous. The mill is now operating at 200 tons per day, with an ample margin of surplus crushing capacity.

The metals mined are zinc, lead, silver and copper, with some gold. Ore is very hard and abrasive. Much of the rock is wet, containing clay and talc, making a difficult crushing problem.

Ore from the mine first passes through a 9' x 30' Tel-smith-Wheeling Roller Bearing Jaw Crusher and is crushed to about minus 1 1/2". Then it is conveyed to a 2' x 6' Tel-smith Single Deck Pulsator, with 3/4" square openings in screen cloth. Oversize from this vibrating screen goes to a No. 24 Tel-smith Gyrasphere Crusher originally set to deliver minus 1/2", now minus 3/4" product. According

to the management this Gyrasphere has given excellent service... crushing from 5700 to 11,000 tons of ore with one set of manganese wearing parts, this wide variation being due to the change in adjustment. Oiling system is positive, without dust seal failures. Repair expense is moderate; mechanical performance has been satisfactory; and power consumption low. The Basin-Montana people report, "We like Tel-smith equipment."

Write for descriptive Bulletins—Y-34 Tel-smith Gyrasphere Crusher; W-34 Tel-smith-Wheeling Jaw Crusher; V-34 Tel-smith Pulsator.

TRAMP IRON DOES NOT STOP TELSMITH

Actual photograph of tramp iron which passed through both Tel-smith Jaw Crusher and Gyrasphere Crusher in plant of Basin-Montana Co., yet failed to damage either crusher in any way.

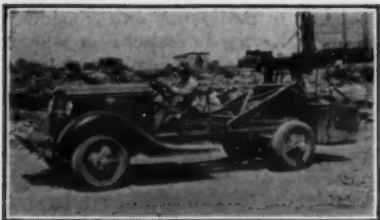


SMITH ENGINEERING WORKS, 4014 N. HOLTON ST., MILWAUKEE, WIS.

Associates in Canada: Canadian Ingersoll-Rand Co., Ltd., Montreal, Toronto, Winnipeg, Vancouver

M-5-C

TELSMITH



C. & R. M. Photo
The Special Hauling Truck with One of the Quarry Skips

Aggregate Production For Ind. Road-Mix Job

(Continued from page 5)

Crushing and Screening

The one-man and smaller stone delivered by skip to the crusher hopper was fed by one man to the 10 x 40 Good Roads jaw crusher set to produce maximum $3\frac{1}{2}$ -inch stone. This dropped through a chute to the third bucket from the bottom of the Columbus bucket elevator. The reason for this was greater efficiency in loading the 16-inch buckets and any material spilled from the chute and between the concrete piers supporting the crusher on one side and the bins on the other could readily be hand shoveled to the two lower buckets. The bucket elevator was 36 feet between centers of the top and bottom pulleys.

The material elevated was thrown against a shield at the top and dropped directly into another chute delivering to a wider chute at right angles. This last chute was the same width as the vibrating screens and had a baffle at the end to prevent the material jumping the first section of the screen. The double-deck Niagara screens were 3 x 8-foot units. The top deck took out all $3\frac{1}{2}$ -inch stone and smaller and delivered the oversize to a chute carrying it to the reduction crusher. The lower deck of the screen had a 5-foot section of $\frac{3}{4}$ -inch square mesh, and 3 feet of $1\frac{1}{2}$ -inch square mesh. All aggregates were delivered to three bins which acted as surge bins for the material as it was removed to the road practically as soon as produced.

The oversize was reduced to fines in a Traylor gyratory finishing crusher. The reduction crusher drive was taken off a second jaw crusher pulley to a line shaft and then back to the reduction crusher pulley. The pulleys for this drive were made by the contractor by welding two old automobile brake drums together and then turned down on a lathe.

The plant was worked two 6-hour shifts and readily produced 500 tons of screened aggregate in three sizes daily. Only four men were needed to operate the plant, a Plant Foreman, the feeder man and two laborers on the plant.

The entire plant was gone over every morning and noon and every bearing lubricated with the correct amount of grease or oil and of the quality recommended by the manufacturer of the equipment. For the Caterpillar diesel, Standard Oil of California diesel lubricating oil was used and on the crusher, Good Roads summer gear grease.

Hauling to the Road

The contractor maintained a fleet of three 3-ton International trucks which hauled uniform loads of 8 tons per trip from the 125-ton aggregate bins and dumped direct to the road by tripping the tail gates.

Personnel

The contract for the road-mix surface complete was awarded to L. P. Cavett Co. of Lockland, Ohio, for \$93,144.81. The work was completed under the direction of Earl C. Burgess, Superintendent. Albert Berry and Max Radcliff were responsible for the operation of the quarry and crushing and screening plant and hauling to the job. For the State Highway Commission the work was in charge of Orville O'Neal, Project Engineer.

Road Roller Made in Japan

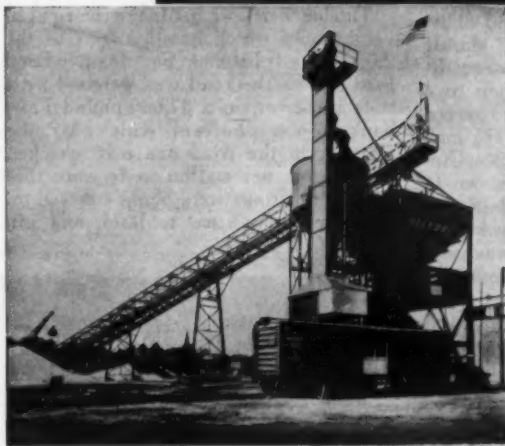
The newest addition to the list of made-in-Japan products is a road roller, which Japan has heretofore been unable to make profitably, according to a report from the U. S. Assistant Trade Commissioner at Tokyo.

A 6-ton road roller, recently delivered to the Nagoya Municipality by

Hakata, is constructed entirely of locally-made parts, although it was modeled after the product of an American company. It is equipped with a Continental engine, and moves backward. Rollers of this type are available in weights of 6, 8 and 10 tons.

Heltzel

BUILDS IT BETTER



As an example, the central mixing plant illustrated here is built to give years of service. Large plants are so constructed as to be easily operated by one man.

For handling and batching concrete aggregates, Heltzel Plants will turn time and labor into a profit for you.

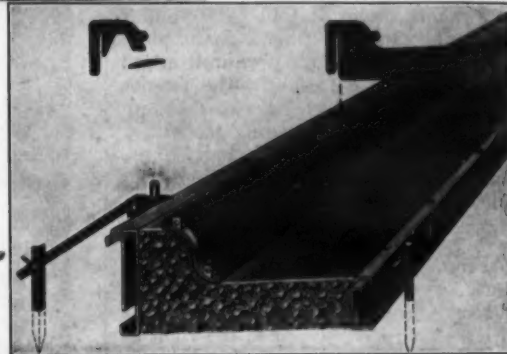


Illustration to the right is combined Curb-and-Gutter form with double radius face form. It's easy to set up... easy to strip... and durable.

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Manufacturers for over a Quarter Century

CENTER CONTROL means Full Control!

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Contractors everywhere will appreciate the ample power, grip-like traction, easy and positive manipulation of the New WARCO Center Control Graders. These features combined with the sturdy construction and correctly balanced weight enables them to perform a vast amount of construction work.

J. & S. TRACTION TREADS



WARCO J & S Traction Treads grip the road surface over which they are traveling with claw-like action. Just the thing for snow, mud, soft or loose ground. Designed and built for heavy duty they will produce maximum traction under severe conditions. Built for either single or dual tired trucks, busses or any equipment using pneumatic tires.



The new WARCO Center Control machines are built to surpass the older type WARCO Center Control Graders which, by their reliability and performance, have gained a wide-spread and favorable reputation.

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SUCCESSOR TO W. A. RIDDELL CO.-HADFIELD-PENFIELD STEEL CO.
AMERICAN CLAY MACHINERY CO.

BUCYRUS, OHIO

INTERESTED DISTRIBUTORS WRITE DEPT. A.

Lubrication System At Grand Coulee

(Continued from page 18)

must operate with these heavy loads over long distances in compound gears. A glance at the equipment list shows that in the case of the heavy trucks they do not send boys to do men's work. Twelve cubic yards to the load up out of mud holes and over steep grades calls for plenty of power well lubricated. It is no wonder, then, that heavy trucks are checked every seven hours and oil changed every seven days on the average.

And is that lubrication engineer busy! The extreme heat and long pulls in low gears brought up problems in the lubrication of differentials. And again, when the west side cofferdam was being excavated, the trucks had to go through heavy clay, uphill, carrying 15 cubic yards of the same stuff, weighing 3,500 pounds to the cubic yard. Don't get out your pencil, here it is—52,500 pounds, which is 26½ tons. This presented another problem when it came to the dual rear ends of the Whites. Ordinary grease does not have the extreme film pressure required for such work. The oil company had to develop a special grease, which received its first test at Grand Coulee. It is too bad they would not tell more about it. Apparently it is a secret of some kind. At any rate, the new lubricant had to be thin enough to radiate heat rapidly and still stay in the grease category and retain sufficient lubricating properties so that under the tremendous pressures it would not squeeze out of the bearing surface. Similarly, a special internal oil in which the carbon was kept to a minimum had to be developed for the tractors.

Checking Is Frequent

When it was said that the big trucks are checked every seven hours on the average, that is only half of it. When the pulling is especially hard, the checking is done every three hours. Day and night, a lubrication truck makes the rounds of the whole area. Six grease monkeys ride the truck, while others are stationed around at strategic points to lend a hand. When these grease monkeys descend on a truck and ply their trade on it for about five to ten minutes, that truck knows that it has been taken to the cleaners. Of course, they do the same thing to tractors, buggies, shovels and other equipment. These boys do their work thoroughly and quickly, and theirs is one of the really important roles on the job, for without grease and oil Coulee could not go on.

The light trucks get a complete lubricating service every three days. This, on the mileage basis, averages every 300 miles. This lubrication service, seemingly rather frequent, serves a double purpose. While it is being done, the truck is given a thorough mechanical inspection, which means that incipient mechanical troubles are caught and large repair jobs later obviated.

In lubricants, they standardize on 10 to 60 for motor oils; 90 to 250 in transmission oils; turbine oil for reduction gears, hydraulic and similar equipment requiring light lubrication; cup greases that are better than the average commercial grade for jackhammers, conveyor rolls and the like. In fuels, it is tetra-ethyl gasoline, 27 and 34 diesel oil and 18 plus and 14 plus crude oil.

Lubrication Stations

The central point of the lubrication activities is the main oil house, which is located adjacent to the main shops on the east side of the river and not far from the administration offices in Mason City. In addition to it are four substations. One of these is at the gravel pit, another in the east side excavation, a third at the Ryan dump and the fourth, at the shop

where the small trucks and passenger cars are serviced. Only oils and greases are distributed from the substations, no gas service. All gas has to pass through the one fuel pump at the oil house, where the lubrication engineer has his headquarters. It is there delivered either direct to the trucks or to a 500-gallon service truck which travels over the job.

While the oil company does deliver barrel lots out on the job where necessary, all products must be cleared through the oil house. The lubrication engineer and his staff constitute the ordering department. He may order barrel lots to be delivered to other points, but he keeps all the records, as any distributor would who ordered direct-from-factory shipments to the consumer.

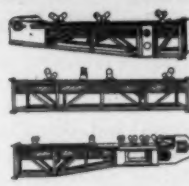
In the case of lubricants as in that of other kinds of products, there are always foremen and operators who have their individual preferences. They think that some particular grade of oil or grease is far superior to any other for their particular purposes. Do they get it for the asking? Decidedly not. In

such an event, there would be a snarl in no time, and the oil house would be carrying a little of everything and have accurate data on nothing. Instead, if any one asks for any special lubricant, the case is first carefully studied by the lubrication engineer. He goes into the

matter on a scientific basis, checking not only the results that might be obtained through the use of the special, but also its cost as compared with those results. While better results are the prime object, with cost secondary, no one is

(Continued on page 49)

NEW WAYS TO CUT MATERIALS HANDLING COSTS



The flexibility and adaptability of the Porta "Model 347" sectional conveyor offers wide opportunities for cutting costs and increasing profit in the handling of concrete and aggregates.

Made up of independent sections.

Can be used on wheel truck, caterpillar mounting or on supports as permanent or semi-permanent conveyor.

Easily disassembled, easily transported, easily reassembled. Our catalog describes our complete line of portable, sectional, and permanent conveyors designed to suit every contractor's requirement.

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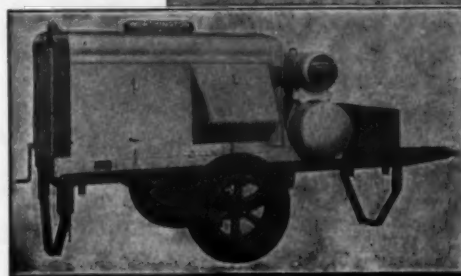
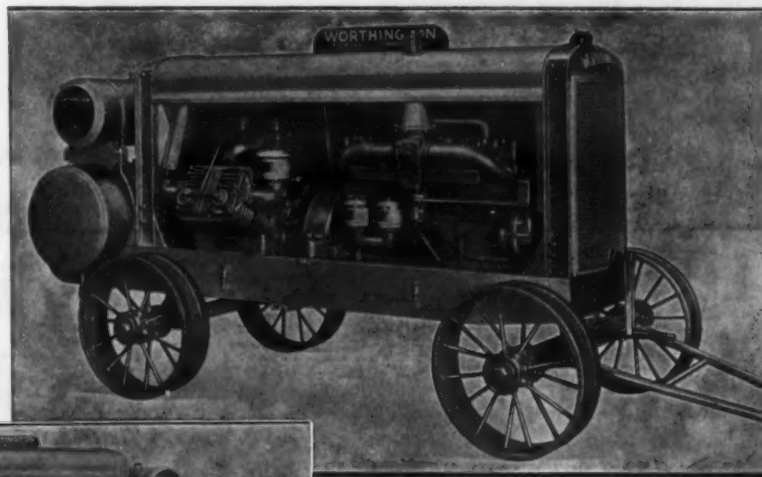


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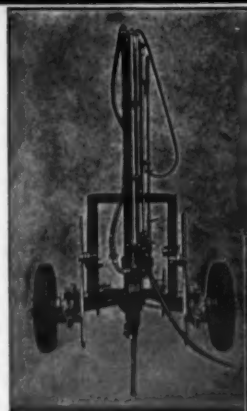
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cu. ft.
actual
capacity

Every
type of
mounting



Worthington Rock Master

- drill can be set at any angle, on any type of job
- pneumatic tires make this unit readily towable



THESE compressor units will stay on the job until the last hole has been drilled... until the last shoulder has been tamped.

And when the air tools on the job are Worthington's... the stick-to-it-factor is 100%.

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SEATTLE
TULSA
WASHINGTON

PC7-1



The New Bucyrus-Armstrong 42-T Blast Hole Drill

New Blast-Hole Drill Has Fast Drilling Rate

A new blast-hole drill, designed to put down large diameter holes, from 9 to 12 inches, at a faster drilling rate than previous models, has been announced by the Bucyrus-Erie Co., South Milwaukee, Wis.

This Bucyrus-Armstrong 42-T drill swings up to 6,000 pounds of cable tools, providing great drilling energy at the bottom of the hole. The exclusive Bucyrus-Armstrong rubber shock absorbers give snap to the tools. The widespread full-length crawler mountings make moving easy and the all-steel welded construction is designed to give strength, long life and low maintenance

expense.

One of the new features of the 42-T is a power-driven tool wrench which sets up and breaks tool joints entirely by power. Raising the 48-foot telescoping derrick is also done by power from the engine, which is an 80-hp diesel or a powerful electric motor, as desired.

Complete information on these new drills may be secured direct from the Bucyrus-Erie Co. by mentioning this magazine.

New British Book on Asphalt Roads

The fifth of a series of books on street and highway construction of the bituminous type has recently made its appearance in England and the United States. The Road Makers' Library, edited by Percy Edwin Spielmann, is a very definite contribution to paving literature. The present book "Asphalt Roads" was prepared by Mr. Spielmann and A. C. Hughes, County Surveyor for Hampshire, England. The earlier books are Road Making and Administration, The Testing of Bituminous Mixtures, Road Aggregates, and Highway and Road Traffic Law.

The new volume starts with an historical introduction discussing natural asphalt deposits in France, Germany, Italy, Switzerland and Trinidad. Part 2 is devoted to asphaltic bitumen and natural asphalt, Part 3 to bitumen mixtures, and Part 4 to types of aggregates, the relation between aggregates and the bitumen and various types of asphalt surfacing, their weaknesses and methods of correcting defects. Part 5 is devoted to laboratory investigations and tests. An excellent bibliography and index completes the volume which contains 319 pages and is published by Edward Arnold & Co., London, England, and Longmans, Green & Co., 114 Fifth Ave., New York. The price is \$9.00.

Improved Model of 2-Inch Self-Priming Centrifugal

The latest improved model of the Barnes 7M 7,000-gph self-priming centrifugal pump, known as the Little Champion, has just been announced by the Barnes Manufacturing Co., Mansfield, Ohio. This portable outfit is designed for use by contractors, state and county highway engineers where temporary pumping service and quick action are required.

The 7M is powered by a Briggs & Stratton Model B engine, is 20 inches long, 17 inches wide, 24 inches high and weighs 225 pounds. It has a suction discharge of 2 inches right or left, and the unit is mounted on a 2-wheel truck with handle and lifting bail.

One of these pumps was placed on a construction job, 8 feet from the water, with an 8-foot suction lift, and a 2-inch pipe 10 feet high on the discharge. Water was forced through a 2-inch pipe 300 feet from the pump. The manu-

facturer claims that the pump primed itself in 18 seconds, started delivering water in less than 2 minutes after the pump was started, and delivered a full 2-inch stream to the end of the discharge pipe.

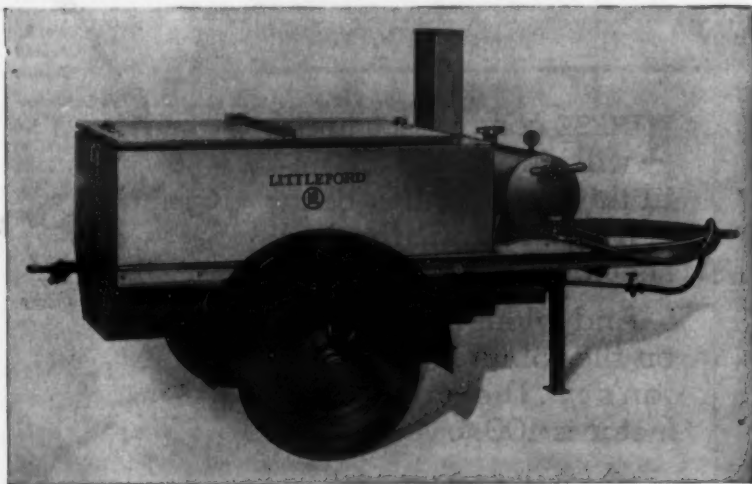
Complete information on this new pump is contained in a new catalog which may be secured direct from the manufacturer by mentioning this magazine.

COMPLETE WELL POINT SYSTEMS WILL DRY UP ANY EXCAVATION

Faster—More Economically
Write for Job Estimates and Literature

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VISIT THE LITTLEFORD BOOTH At the New Orleans Road Show



This Modern, High Speed Heating Kettle is the New 1937 Littleford No. 84-HD.

A sleek looking job, isn't it? Looks like it was built for speed—for present day traffic. Well, it is. It's just as speedy as it looks. You can trail it 40 miles per hour if you want—with a load on. When it comes to heating—well, the Littleford No. 84-HD Kettle with its "Double Heat Circulation" and "Screened Reservoir" is

the fastest heater we know of. Add the 1937 No. 84-HD to your maintenance equipment. Use a high speed kettle in your efforts to match present high speed traffic's effect on your roads. Available in sizes 50 to 210 gallons. Ask for full details.



LITTLEFORD
Road Maintenance Equipment
SINCE 1900

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50% MORE DIRT MOVED
with a
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Users Report On Yardage Increases—

Read What They Say

A Contractor writes: "It comes nearest to doing the work of a shovel bucket in rock with all the advantages of the dragline that I believe possible."

From a gravel plant owner: "Has increased our production at least 75%. To us the Page AUTOMATIC is the ONLY bucket for dragline work."

A strip mine operator says: "Can truthfully say that since putting on your AUTOMATIC we are stripping at least 50% more material." *From letters in our files.

You also can increase your yardage and dragline profits! For information on a size and weight AUTOMATIC bucket for your machine and job—see your equipment dealer or write us direct. Free bulletin "The AUTOMATIC" gladly sent on request. Address Dept. N.

"DIG WITH A PAGE AUTOMATIC"

PAGE ENGINEERING COMPANY
CLEARING POST OFFICE CHICAGO, ILLINOIS

A 7,000,000-Yard Highway Cut

(Continued from page 21)

Several sections were built up with the wire fence checks alone. These are made of triangular mesh wire fencing with 4 to 6-inch spacing attached to the 4-inch fence posts. The gravel quickly loads the mesh and acts as a filter for the material, holding back finer and finer material until it is completely clogged and the very finest sand is deposited behind it. These fences frequently sagged under the load and were replaced by the double fence system with brush added.

The strongest and most successful checks were built of 4-inch posts driven 3 feet into the fill and projecting 5 feet above. These were placed 4 feet on centers with the second row staggered 4 feet from the first. The tops of the posts were laced together with heavy wire stapled to the posts, giving greater strength for the entire system. These checks were carried out 100 feet from the center line of the new roadway for protection and as the material was readily available for the large fills. The posts were used to hold both brush and the regular wire fence with the wires spaced 3 inches horizontally and 4 inches vertically. The lines of checks were placed 150 to 200 feet apart and at right angles to the line of the roadway. The brush was used chiefly along the edge of the fills where it can be burned when the work is completed. Then willow stakes will be planted along the edge of the fill to hold it against the wash.

When the fill was started at the general location over Oregon City, a temporary 24-inch corrugated metal culvert was placed on a trestle about 10 feet above the fill to act as a drain for a small lake that would be created when the fill reached a higher elevation. Now the culvert is 10 feet below the top of the fill and is draining an attractive small lake that has already caught the attention of the people driving over the road because of its sandy beach formed by the deposit of the hydraulicked material. The culvert empties into a crib filled with brush so that the water will not wash out the fill.

Personnel

The work of operating the hydraulic giants is under the direction of M. A. Senger as Superintendent for the California Division of Highways. Mr. Senger was formerly Superintendent for the LaGrange Placer Mines, Inc., and knows the material in which he is operating very well.

1937 Model 3/8-Yard Shovel

A feature of the 1937 model Bearcat Jr., manufactured by the Byers Machine Co., Ravenna, Ohio, is the newly designed modern cab giving complete protection to the machinery and increased operating efficiency. The manufacturer also claims that this year's shovel will decrease gas and oil consumption to 10 gallons of gas and a quarter of a pint of oil for 8 hours' operation.

By eliminating dead weight, this 3/4-swing shovel is now light enough to be transported on a heavy-duty truck. On its own trailer, the Bearcat Jr. can be towed at speeds of 30 to 35 mph. By using an automobile-type transmission, the operator has three travel speeds and variable digging speeds from the 36-hp industrial type, slow-speed motor.

This 1937 model can be used as a shovel, clamshell, dragline, crane or trencher. It is claimed that it will dig from 250 to 300 cubic yards a day at a cost of less than \$6.00, exclusive of operator's wages.

New Tool for Blockholing

Much time is lost on many excavating jobs when boulders too large for the shovel to handle are encountered or when ledge breaks into too large pieces. If rock tongs are not handy, the contractor must resort to blockholing and clear the job while the powder monkey "pops" the rock. A new tool which eliminates this delay has been announced by the Atlantic Steel Co., 1775 Broadway, New York City.

The Atlantic pneumatic rock breaker is in reality a pneumatic-driven plug. It is only necessary to drill a hole in the rock about 12 inches deep, insert the rock breaker in a pneumatic paving breaker, place the rock breaker in the drilled hole, and after short pounding, the rock will split readily. It is preferable that the rock be clear of earth on three sides. These breakers are made of a specially heat-treated Atsco steel which will withstand unusual abuse. The tool fits any standard pneumatic

paving breaker and is made in several sizes with 1 1/8-inch and 1 1/4-inch hexagon shanks.



The Atlantic Steel Co. also makes bull points, asphalt cutters, digging chisels, tamping tools, drills and chisels.

Mall BUILDS THE COMPLETE LINE!

Concrete vibrators for every type and size of job—electric motor, gas engine, and air driven units for placing harsh mixes of low slump concrete in walls, dams, bridges, pavements, and culverts. Attachments available for concrete surfacing, drilling, grinding, pumping, and sawing.

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Illustrated: MALL portable gas engine unit placing concrete on thin wall sections.

HERCULES POWER HELPS PAVE SAN FRANCISCO-OAKLAND BAY BRIDGE



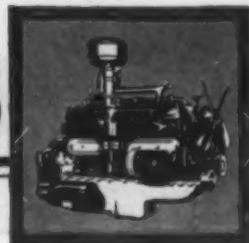
The new San Francisco-Oakland Bay Bridge is the longest bridge in the world. To pave both decks of this great bridge with concrete was a large contract in itself. Two specially designed Jaeger-Lakewood Finishing Machines were used. Both of them were powered with Model IXB, Hercules 4-cylinder gasoline power units. From start to finish Hercules power played

its part in bringing this tremendous project to completion six months ahead of the scheduled time. Hercules builds more heavy-duty power plants than any other manufacturer producing only internal combustion engines. Such widespread acceptance is the result of over twenty years' experience in designing and building heavy-duty engines exclusively.

HERCULES MOTORS CORPORATION, CANTON, OHIO

America's Foremost Engine Manufacturer • Power Plants from 4 to 200 H. P.

HERCULES



ENGINES

Tax Problems

(Continued from page 34)

from the landlord thereof; and (c) furnishes his own equipment or, where equipment is not an important factor in the performance of the work, furnishes material; and (d) contracts to perform the work on a job basis.

The presumption created by the fulfillment of all these conditions is not to be deemed conclusive, and the Commissioner may, on the facts in any particular case, rule that a person is not doing business as an independent contractor, even though he fulfills each of these conditions.

The failure to fulfill each of these conditions shall likewise not be deemed conclusive, and the Commissioner may, on the facts in any particular case, find that a person is doing business as an independent employer even though he does not fulfill each of these conditions.

An independent employer shall be exclusively liable for contributions on the payroll of such of his employees as are covered by the Act and there shall be no liability for such contributions upon anyone for whom such independent employer performs work.

Independent Persons

As interpreted by the New York Division of Unemployment Insurance, an independent person is a party contracting with another without becoming thereby "an employee" or "subcontractor." In defining "independent person," generally the precedents laid down by the courts in workmen's compensation cases will be followed.

Generally, an independent person does the work of the principal with whom he contracts without supervision by such person as to his methods of doing it and his own financial responsibility. He usually receives a lump sum agreed upon in advance, rather than pay by the day or hour, and is not bound to regular hours of work nor subject to discharge. Pursuant to this principle, it is entirely consistent that one performing different types of work may be as to one type an employee and as to another an independent contractor.

Exclusion of Government Work

Both under the Federal Social Security Act and the state unemployment insurance laws, services performed in the employ of the Federal and state governments or any political subdivision of instrumentality thereof, including any agency or government without distinction between those exercising functions of a governmental nature and those exercising functions of a proprietary nature, are exempted. Public utilities operated as a part of a municipal government are therefore exempted from being subject to the law. In highway or heavy construction work performed for counties or municipalities, where the right of control, hiring, discharging, payment and general supervision of employees rests in the municipality, the relation of employer and employee between the governmental agency and the independent contractor will result in complete exemption from the tax.

Where, however, these contractors are not subject to such control, or are collectively operating under the control of an intermediate contractor having direct relation with the governmental unit, the relation of independent contractor exists, and if otherwise subject to the provisions of the federal and state laws, their labor will constitute employment subject to the Acts.

Remuneration Included in Payroll

In determining the basis of the federal excise tax imposed by Title IX, relating to unemployment insurance, of the Federal Social Security Act and the state payroll tax laws, the basis of the

tax is the amount of wages paid by an employer to an employee who is subject to the Act. Under the federal provisions all wages are included which are payable within the taxable year, even though actual payment is not made within that period.

Under the New York Act only such persons are included within the term "employee" who are employed at manual labor at not more than \$2,600 per year or \$50 per week.

Wages under the New York Act are "every form of remuneration for employment received by an employee from his employer, whether paid directly or indirectly, including salaries, commissions, bonuses and the reasonable value of board, rent, housing, lodging or similar advantages received." The Federal Act defines wages as "all remuneration for employment, including the cash value of all remuneration paid in any medium other than cash." Such remuneration must be for "employment,"

however. Thus, in the case of hiring an individual and his equipment, such as

a truck, the employer is liable for con-
(Continued on following page)

PORTABLE ASPHALT PLANTS TOWER TYPE

LARGE CAPACITIES
HOT OR COLD MIX

Accurate control of materials to comply with any standard specifications for bituminous mixtures.

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HETHERINGTON AND BERNER INC

Indianapolis, Indiana



3 1/2-T MIXER

For fast trailing and rapid mixing. Wide-tread rubber wheels, shock absorbers—Hyatt roller bearing wheels—Alumite fittings—Lauson 2 H.P. gasoline engine. Get current prices and details.



K-4 CONCRETE BARROW

Pneumatic-tired—handles 4 cu. ft. wet concrete, 6 cu. ft. dry material—round bottom bowl—easy dumping, easy handling. Ask for complete data, etc.



F-4 1/2 BARROW

LANSING

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GET in position to meet competition—fill specifications and contracts—and make a PROFIT. Contractors and engineers have depended upon the known stability of Lansing Equipment for over half a century. Why not capitalize on Lansing, too?

LANSING CONCRETE MIXERS

Lansing Mixers are snappy, fast workers. The 7-5 elevates charging chute into a large, over-size drum—in 8 seconds! 20-inch drum opening. Powered by 8 H.P. 2-cylinder gasoline engine. Constructed for thorough mixing, quick discharging. Optional Equipment: Power side-loader, automatic water-tank, loading platform, electric power, etc.

The Lansing 10-5 is another rugged, dependable mixer, with 10 cu. ft. capacity, Hyatt bearings, rubber-tired wheels, 12 H.P. LaRoi engine, etc. Write—TODAY—for complete information and costs of either of these famous Mixers.



LANSING 7-5

LANSING COMPANY, Lansing, Michigan

CHICAGO NEW YORK PHILADELPHIA BOSTON MINNEAPOLIS KANSAS CITY SAN FRANCISCO

fast

"FOR HIGH SPEED WORK,
GIVE ME A MICHIGAN!"



I've run lots of shovels in my time and I know what a real day's work with the ordinary type means, too! That's why I'm strong for the MICHIGAN . . . For several years now, the boss has bought MICHIGAN Truck Shovels for the high speed jobs. He knows that Michigan's AIR CONTROLLED CLUTCHES are faster, and they keep his operators at top efficiency without fatigue ALL DAY . . . Fingertip Air Controls are not new with the MICHIGAN. Their dependability has already been proved by seven years of actual use.

AIR CONTROLS are but ONE feature—Write for the MICHIGAN DATA BOOKLET "C" today

MICHIGAN TRUCK SHOVEL—3/8 yard capacity—25 m.p.h. road speed.

MICHIGAN POWER SHOVEL CO.
MILLER ROAD
BENTON HARBOR MICH.

Tax Problems

(Continued from preceding page)

tributions based on the remuneration for services only. Equipment is only rented and its rental value should not be included in the basis for contributions, provided it is accounted for separately.

Expenses incurred by the employee in the course of the performance of his activities, for which he is reimbursed, should be excluded from the payroll upon which contributions are based, provided they are accounted for separately and do not represent, directly or indirectly, remuneration for employment. Tuitions for employees' training courses paid for by employers do not constitute remuneration. So-called super money reimbursing employees' expenses is not remuneration, nor will the occasional or limited personal use of a company car kept in the custody of an employee constitute part of his wages. Gratuities, such as Christmas gifts, are considered wages. Payment made by an employer to a dismissed employee in addition to wages earned is not the basis for contribution. Meals given to employees must be considered as remuneration under the law, and their value must be included in the calculation of wages. Contributions are due on wages of temporary employees as well as on wages of permanent employees. The law requires contributions on wages paid to every employee, however short his period of employment may be.

Amounts deducted from the remuneration of an employee by an employer constitute wages paid to the employee at the time of such deduction, under the Social Security Act. It is immaterial that the Act or any Act of Congress, or the law of any state, requires or permits such deduction and the payment thereof to the United States, a state or any political subdivision thereof.

In the fourth article of this series, in the February issue, U. S. Greene, Certified Public Accountant and co-author of "Planning for Tax Economy," will discuss records and accounting under the Federal Social Security Act and state payroll tax laws.

The Ministers of Public Works and Finance of Uruguay have prepared a project for the emission of up to 15,000,000 pesos (about \$11,820,000) in bonds in 1937 and 1938, the proceeds of all but about \$1,182,000 of which will be used in the construction and reconstruction of roads, according to a recent report from the U. S. Bureau of Foreign and Domestic Commerce.

Improving Road-Mix

A unique method for denser macadam mixtures has been recently developed. The usual gradation of macadam aggregate, from $\frac{1}{4}$ to $1\frac{1}{4}$ -inch, is spread upon the road surface at a uniform rate per square yard. The asphalt is then applied by pressure distributor as in the usual method of macadam aggregate road-mix. Instead of next mixing the two together, however, an application of fine aggregate is made over the freshly treated coarse aggregate and which, instead of settling to the bottom, is retained on the surface of the coarse aggregate by the asphalt.

Mixing then follows and by suitable proportioning of the fine aggregate and using very rapid-curing asphaltic products, road-mix surfaces resembling asphaltic concrete may be easily obtained. Some of the new road-mixing equipment having rotating blades similar to a pug-mill greatly facilitate the mixing of such finer aggregate, according to

Bernard E. Gray, Chief Highway Engineer, The Asphalt Institute, in his paper presented before the North Atlantic Highway Officials Association,

and yet retain through the spreading and screeding operations the advantages inherent in the road-mixing method through use of a long wheel base.

FRINK
SNO-PLOWS

A Size For
Every
Motor Truck



Manual or
Power Hy-
draulic Control

CARL H. FRINK, Mfr.
Clayton, 1000 Islands, New York

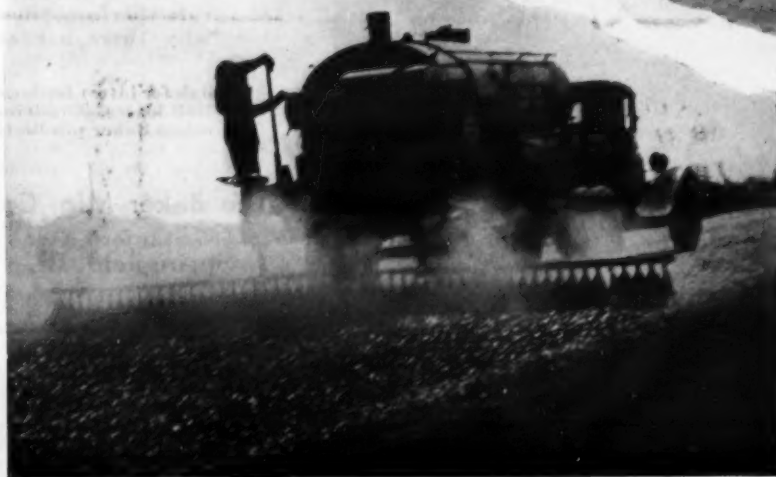
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Pressure Distributor

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**If You Want Modern, Economical
Black Top Road Maintenance—**

Here's the Unit for You!
Littleford No. 101 Sprayer

One maintenance outfit that does your patching, shoulder redressing—all your black top repairs; uses any kind or type of tar, asphalt or oil you want. The No. 101 will save you money, time and headaches in 1937. Ask about it, now.

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LITTLEFORD
Road Maintenance Equipment
SINCE 1900

LITTLEFORD BROS. 485 E. PEARL ST. CINCINNATI, O.

**Ask about these
Features**

Quicker, less expensive heating.
Trouble free, single valve control.
Absolutely accurate application.
Non dribbling Spray Bars.
Instant Cut-in and Cut-off of Sprays.
No auxiliary burner needed to thaw
out pump, valve and piping.
"Suck Back" type of manifold bar,
spray bars and feed lines.
Strainers in all lines—easy to remove
for cleaning or replacing.



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SPLIT SHAFT
POWER TAKE-OFF



for ANY TRUCK
ANY PORTABLE
EQUIPMENT

Hercules Split-Shaft Power Take-Offs are not transmission take-offs. They are installed in the drive shaft to transmit all of the power of the truck motor direct to any portable equipment. Various models available to operate as direct drive or from the side.

Consult Hercules Engineers with your Power Take-Off requirements.

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GALION, OHIO, U. S. A.

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Littleford Bros., 485 E. Pearl St.,
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Send all the facts on how a Littleford

☐ Pressure Distributor of _____ gal. cap.
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can benefit me. This does not obligate me.

Name _____

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The Hug Model 30 Lugger

New Scoop-End Lugger Announced by Hug

A new Model 30 Hug Lugger, powered with a Show-Down Caterpillar diesel engine, has been announced by the Hug Co., Highland, Ill. This engine, which uses low-cost diesel fuels, is a four-cycle water-cooled Model D8800, with a displacement of 831 cubic inches and an A.M.A. rating of 52.9. Transmission provides twelve speeds forward and three reverse.

Many innovations in design and construction are incorporated in the chassis of this new Hug Lugger. The entire frame is electrically arc-welded and the set-back wheel design allows short turning radius and ease of handling. Trusses, spring hangers, motor hangers, radius rod braces and box section cross members are all electrically arc-welded to the side rails, forming one rigid structure.

The body is the Hug Scoop-End model with direct reversible high dumping angle hoist. There is no tail gate and the body sides are reinforced with I-beam steel ribs. The body has a 10-yard capacity and the maximum pay load of the unit is 30,000 pounds.

Sodium Lights Installed On 18-Mile N. Y. Highway

For 18 miles New York State Route 7 leading into the city of Schenectady is now lighted with sodium vapor units. This is said to be the longest single stretch of sodium highway lighting in the world. A total of 391 G-E 10,000-lumen sodium units are mounted about 250 feet apart on alternate sides of the road except on curves where they are placed on the outside.

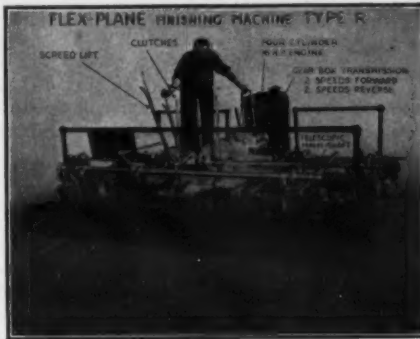
This 18-mile installation surpasses in length the stretch of golden light for the San Francisco-Oakland Bay Bridge, which was put in operation this fall. The latter, however, employs over 900

sodium units on the upper and lower decks of the 8.25-mile span, the world's longest bridge.

Schenectady County started its highway lighting program in 1929 when a 1-mile experimental strip of lighting units was installed along the Amsterdam road. The next year an additional 15 miles was lighted on sections of the Albany, Troy, and Amsterdam roads. Sixteen miles were illuminated in 1931 when the Mariaville road, from the city of Schenectady to the Montgomery County line, was lighted, and luminaires were installed on the Campbell and River roads. Recently, additional sodium units were turned on along the Schenectady-Albany highway and over the Western Gateway Bridge at the western entrance to Schenectady. Five miles of the Balltown road, a north and south highway east of Schenectady is lighted with 231 incandescent luminaires of special design, using the new 400-candle-power, tubular 1/2-inch bar filament incandescent lamps. These lights are staggered 125 feet apart along the highway.

AND NOW

We wish you a successful New Year. Using "FLEX-PLANE" Finishing Machines and Contraction Joint Installing Machines will help a lot.



Our finishing machine screed is 20" wide and it screeds while the machine is reversing. It builds smoother roads than any other machine. Our joint machines will install any kind of contraction joint. You may also be interested in our curb building machines, mesh strikeoff machines equipped with 8 H.P. engines, or our combination and independent dowel rod and expansion joint installers.

BOOTHS A-76-77 AT THE ROAD SHOW

FLEXIBLE ROAD JOINT MACHINE COMPANY
WARREN, OHIO

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The Bulldozers That Do Not Choose Their Jobs

There's a big difference in Bulldozers. Why not choose the kind that do not pick their jobs—the kind that are ready for any assignment.

Baker Hydraulic Bulldozers are built to handle any bulldozing job. They are simply and sensibly built. Less wasted power—more effective work. With strength to spare and long life, the up-keep costs are away down.

Direct lift—easy, fast operation—few wearing parts—no gears, springs, levers or cranks—correct mounting on the tractor—accurate performance—these are more reasons why there are more Bakers on more jobs.

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Manufacturers of

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ROME Motor Graders

ROME Auto Mowers
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BARGAINS in Construction Equipment

The directors of the Middle Rio Grande Conservancy District have authorized us to offer the last of their construction equipment, made available by completion of the construction work, at bargain prices. This equipment is all in good condition and includes

**50B Bucyrus-Erie
Diesel Draglines
775 P & H Diesel Draglines**

pumps, compressors, lighting plants, tractors, shovels, pile driving outfits, concrete mixers, scales, insley concrete placing outfit, concrete heaters and vibrators, gravel screening plants, compressed air drill sharpeners, shop equipment, gasoline powered hoists with and without skips, bar benders and cutters, carbide floodlights and other items at bargain prices. Wire or write for complete list and prices

R. L. Harrison Co. Inc.
Albuquerque New Mexico

Laying 17.5 Miles Of Oil Mat in N.M.

(Continued from page 10)

right into the surface of the earth and that is just where you find it in the southwest. A gravel pit is just a hole in the ground, but located where the testing engineers of the state highway department have previously dug a test pit and sampled and tested the material to determine its suitability for the oil-mat work.

On this contract there were at least three gravel pits located along the right-of-way and these were used at different times to furnish the material. The overburden was about 5 feet and was removed by a LeTourneau 12-yard scraper pulled by a Caterpillar Seventy-Five diesel. A Bucyrus-Erie 34B 3/4-yard shovel loaded out the pit-run material to two shuttling White trucks which backed to the hopper of the screening plant. A reciprocating feeder delivered the material uniformly to the belt conveyor which carried the sand and gravel to the single-deck vibrating screen of the Cedar Rapids plant. This screen took out all over 1-inch stone, delivering it to the crusher. Crusher-run material was carried to the screen by a bucket elevator and chute. The screened material dropped onto a conveyor which carried it to the loading hopper for the trucks. Loading was controlled by a swing gate which permitted flow to either side of the truck. The complete screening and crushing plant was operated by a 100-hp Waukesha motor.

Three Insley trailers and three motor trucks were used for hauling the material to the road. This plant produced an average of 500 tons of screened material in two 6 1/2-hour shifts. All loads were weighed by a state inspector on Howe platform scales mounted in a pit close to the loading hopper.

In preparing for a contract of this type the state designates a number of acceptable pits along the right-of-way. The contractor can choose those which are most readily reached by his equipment and through agreement with the property owner. The state has an established price of 3 cents a yard or 2 cents a ton for gravel for work of this type from state-tested pits and in case there is trouble with the property owners a court writ is secured awarding the use of the pit to the state's contractor.

Working the Oil Mat

In preparing for the oil-mat work, the state testing engineers take a sample of the aggregate for each 30 feet of road and make screen and oil tests. This permits the state to specify the amount of oil to be applied on each section of the road surface when processing begins. The oil-mat material is spread to the width which can be reached by the distributor nozzles and then it is shot with 3/4-gallon of MC-3 oil per square yard of finished surface 1 1/2-inches thick.

The contractor hauled the road oil from Albuquerque in 3,000-gallon booster tanks mounted on trailers. These were then pumped into the 1,000-gallon Kinney distributor which applied the oil to the road. With the equipment used it was possible for the contractor to complete about 1 1/2 miles of oil-mat surface each day.

The material was processed in lengths of about 1 mile each. A Caterpillar No. 11 diesel Auto Patrol with dual drive and equipped with 12.75 x 24 Firestone Ground Grip tires and a 16-foot blade was used for the mixing. A more elaborate pug-mill mixer, pulled by a 75 tractor in compound gear, was tried but was not found satisfactory in this material which has a maximum size of 3/4-inch. Other sections of the road

were mixed with two other Caterpillar No. 11 diesel patrols and a Galion power grader. Rolling after curing was done with a 10-ton Huber roller.

The application and rolling of the rock asphalt seal was started on June 10. Prior to the spreading of the rock asphalt, the tack coat was applied as described and covered with 18 to 25 pounds per square yard of sand.

During the first part of the job, crusher-run material was stockpiled 2 feet from the edges of the road surface for use in building shoulders when the roadway surface was completed. The shoulders were built tight against the oil mat and rock asphalt courses so as to prevent ravelling.

The major quantities in the estimates for these contracts were:

Item	FAP 178A	FAP 178B
Top course surfacing.....	5,983 tons	9,198 cubic yards
Liquid asphalt road		
oil, MC-3.....	1,899 barrels	3,655 barrels
Base course surfacing.....	3,112 tons	36,907 tons
Binder	5,315 tons	
Rock asphalt seal coat.....	3,019 tons	
Watering base course.....	765 M gals.	566 M gals.
Rolling	165 hours	438 hours
Additional shoulder		
surface material.....	1,998 tons	1,961 tons
Liquid asphalt road		
oil, MC-1.....	1,329 barrels	
Cover material.....		7,337 cubic yards

Personnel

This contract was run as two parts in accordance with the FAP ruling, with G. E. Sherman and C. C. Hauquitz as Superintendents for the New Mexico Construction Co., Inc., of Albuquerque, N. M. For the New Mexico State Highway Department the work was under the direction of Gordon Sumner, District Engineer.

ETNYRE

Instantaneous

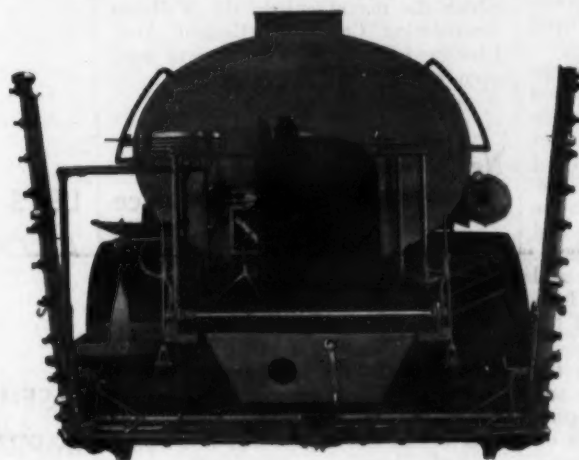
SHUT OFF

A GREAT IMPROVEMENT OVER ORDINARY SPRAY BARS WHICH DRIP!—DRIP!—DRIP!

(As all users of ordinary spray bars know)

ETNYRE
"Non-Drip"
Spray Bar

Has valve at each nozzle to provide instantaneous shut-off action. Full circulating type, supported on hinged brackets. Eliminates "dripping and slobbering." Insures a clean cut, straight starting and finishing line. Most scientific advancement in Bituminous Distributors in years.



Adjustable to
Any Width
of Spray

Etnyre instantaneous shut-off spray bar is made up in sections to give any width required. Standard equipment gives sections to spray up to 24 feet. Additional sections can be had as desired. This is but one of various new features and improvements in the NEW 1937 Etnyre Bituminous Distributors.

The Most Widely Used
BITUMINOUS DISTRIBUTOR
In The World



NEW CATALOG
NOW READY!

The new Etnyre 1937 catalog features the advanced models "FC" and "FX". Gives complete information interesting and helpful to Contractors and Highway officials. Get your copy now . . . ask for catalog No. 506.

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If you have a problem of digging, conveying or stockpiling earth, clay, ore or bulk materials, write for the Sauerman catalog.
SAUERMAN BROS.
464 S. Clinton St. CHICAGO



The New P & H Model 455 1-Yard Excavator

New 1-Yard Excavator Has Tractor Crawlers

Featuring the use of new high-tensile steels and electric welding to reduce its weight, a new high-speed 1-yard excavator, with diesel or gasoline power and equipped with tractor-type crawlers has been announced by the Harnischfeger Corp., 4419 W. National Ave., Milwaukee, Wis. This Model 455 is reported to be stronger and more rigid than its predecessors with more than usual protection against weaving. It has a reinforced cylindrical car body welded integrally with the crawler frames and is further provided with two-speed transmission for every movement in travel and digging.

Standard tractor crawlers of the type manufactured by the Allis-Chalmers Mfg. Co. are used for the first time on a machine of this size. With greater speed and maneuverability than any of its predecessors, the Model 455 is reported to have sufficient resiliency in the track itself to absorb travel shocks and add life to the tough rolled steel shoes. Higher efficiency in power delivery and less noise is secured by the use of helical-cut gears in both reductions of the hoist mechanism.

Two hook rollers are used on the front edge of the live roller circle and four swivel hook rollers on the tipping edge to counteract strains and pulls on the center pin to permit fast, easy swing with the heaviest dipper loads. This model has a full-vision cab and ample space for engine inspection and plenty of room for the operator.

Fast Rehandling Bucket

The Williams Champion cleanup-rehandler is claimed to combine the digging power of the Williams Champion, the speed and easy control of the Williams rehandler and the long reach of the Williams scraper. Its hinges are extra long, the scoops cover a large area and extended corner brackets give extra digging leverage. It also has the Williams Power-Arm combination of lever and block-and-tackle which reduces handling time by developing high digging power with less cable overhaul and wear.

This rehandling bucket has sturdy construction throughout, with heavy renewable digging lips. Its rigid A frame is formed by unusually rugged corner bars, each of which is forged from a single steel billet, with the bearing integral. Roller bearings in sheaves are optional, for high speed operation, and are easily interchangeable with plain sleeve bearings without any extra parts. Due to the absence of side leads of the closing cable on this bucket, roller bearings can be used instead of ball bearings, giving surface contact instead of point contact. The bushings for all moving parts are readily accessible, easy to remove and fitted with flat-type Alemite fittings.

These buckets, which are available in rated capacities of $\frac{3}{4}$, 1, $1\frac{1}{4}$, $1\frac{1}{2}$, $1\frac{3}{4}$, 2, $2\frac{1}{2}$ and 3 yards, are fully described and illustrated in Bulletin P3-50 which the manufacturer, the Wellman Engineering Co., 7012 Central Ave., Cleveland, Ohio, will be glad to send upon request.

New Short $1\frac{1}{2}$ -Ton Truck With Greater Load Space

A new cab-over-engine truck of $1\frac{1}{2}$ -ton capacity, giving greater load space with less overall length, improved load distribution and easier handling, has been announced by International Harvester Co., 606 So. Michigan Ave., Chicago, Ill. This International Model C-300 is available in 99 and 117-inch wheelbase lengths and is adapted to body lengths up to and including a maximum of 15 feet. Its design, while permitting bodies of this length, also permits a reduction in overall length over conventional units, suited

to the same body sizes, of approximately 3 feet.

This design makes possible the ideal weight distribution of one-third on the front and two-thirds on the rear axles resulting in more uniform tire wear on

all six tires and greater braking efficiency, especially on the front wheels due to the increased weight of the front tires. This model also has numerous other features contributing to long life and operating economy.

K & E WYTEFACE

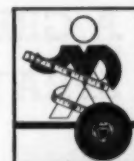
STEEL MEASURING TAPES

for visibility!

This improved steel tape makes life easier for the man on the job. The clear, black-on-white graduations are a decided convenience, and a valuable safeguard against annoying errors.

And WYTEFACE is serviceable. A new resilience prevents kinks or curls; a crack-proof surface protects the steel from rust—exclusive WYTEFACE features that greatly increase the useful life of the line.

You'll want to own a WYTEFACE Steel Tape. Ask your dealer, or write for complete information.



KEUFFEL & ESSER CO.

NEW YORK CHICAGO ST. LOUIS SAN FRANCISCO DETROIT MONTREAL



LET'S TAKE
A LOOK AT →

• SENSATIONAL
IMPROVEMENTS

• NEW ITEMS

• NEW WAYS
OF MAKING
MONEY

SEE US AND TALK
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LINE FOR 1937

BOOTHS B-45 & 46
THE ROAD SHOW
NEW ORLEANS—
JANUARY 11-15

CONSTRUCTION MACHINERY COMPANY
WATERLOO, IOWA

Makers of C.M.C. Mixers—all sizes—pneumatic tired Concrete
Carts, Hoists, Pumps, Saw Rigs, Wheelbarrows. Get our prices
on the most modern equipment in the industry.



Faithful performance

Faithful performance and economical maintenance have been the pillars of Buffalo-Springfield's reputation for forty-six years.

THE BUFFALO-SPRINGFIELD ROLLER CO.
Springfield, Ohio





William Warrens, Lubrication
Engineer At Grand Coulee

Lubrication System At Grand Coulee

(Continued from page 41)

going to get the special product merely because he thinks it may be better. It is the job of the lubrication engineer to find out.

Records Carefully Kept

There is a ticketing system in force at the oil house by means of which every gallon of lubricating oil and grease and every gallon of fuel is charged to the particular truck or car using it. Ask the lubrication engineer for the amount of lubricant, or fuel oil or gasoline per hour of operation of any automotive vehicle and he can find it for you. They figure these items in terms of per hour of operation rather than per mile of operation. Miles do not mean much in pulls like these, which may be upward toward the sky or through axle-deep mud.

It is not to be assumed, however, that these minute records are continually scanned and pattered over. The main thing is to build a dam and not juggle records. The point is, however, that the information is there if needed. If a report comes in that a certain truck or tractor is using an inordinate amount of gas or grease, just the say so of one person is not taken for granted. The record for the machine is checked. If the report is correct, the grease truck crew is ordered to make an immediate investigation and find the cause. It may then turn out that the machine is to be sent to the shop and a remedy applied.

As a matter of routine, however, certain groups of machines are checked as to lubricant consumption from these records, regardless of any reports of individual troubles. A particular make of trucks may be thrown into one group, tractors into another, and so on. Comparison of figures of this nature do have an influence on the selection of a certain type of machinery as against other types.

All trucks are equipped with Oil Pure filters. There are also Skinner filters in the shop, so that the drainings may be refined and used for other purposes, most of the reclaimed product being used as hoist oil.

Cleaning Also Important

While not strictly a lubrication problem, cleaning frequently is important to truck operation, and works hand in hand with lubrication. Therefore, the light truck transportation department is provided with a complete steam cleaning plant, manufactured by the Clayton Mfg. Co., Alhambra, Calif., and known as the Kerrick Kleaner. Turco cleaner is used with the steam and stripper of the same brand, in case a paint job is required.

This much on only one phase of the lubrication problem at Grand Coulee serves merely to indicate the immensity of the problem as a whole. When other phases are considered, such as the lubrication of the machinery of the aggregates production plant; the conveyor systems; Eastmix and Westmix, the two concrete batching and mixing plants; the

machine shop equipment; locomotives on the concrete placing trestles; grouting plant; wood working machinery in the form-making yards; shovels and pile drivers and lifting devices; and even of the innumerable small tools such as jackhammers, drift bolt drivers and power saws, etc., it will be realized that the automotive equipment, important as it is, after all is only a phase.

Even Nature herself may be said to have employed lubrication on a mammoth scale in her efforts to circumvent the plans of men in their efforts to return the waters of the great Columbia to the channel which ages ago she had dug and then found undesirable. With her favorite brand of high alumina clay and water lubricant, which geologists so aptly term "slickensides," she has caused hillsides of earth to slide, filling excavations and moving bridge piers. Yet the work goes on, and in the end man-made greases and oils will bribe Grand Coulee Dam into being.

HERCULES IRONER ROLL

Remarkable results in eliminating high spots

Produces a road with unusual riding and wearing qualities in keeping with today's heavy requirements.

SCARIFIER
ATTACHMENT
Delivers the full
scarifying pres-
sure along the en-
tire row of teeth.
GRADE
BLADE, SCARI-
FIER and IRON-
ER ROLL make
the HERCULES
a complete, effi-
cient mainte-
nance unit.

THE HERCULES CO.
MARION, OHIO



WRITE
FOR
CIRCULAR
"The
Reasons
Why"

MORE PAY YARDS PER LOAD!



The problem—move 600,000 yards of silicon rock soil on grading project for new U.S. Highway 40 between Hagerstown and Frederick, Maryland.

The solution—Four 12 cu. yd. Heil Hydraulic Dig-N-Carry scrapers. Carefully checked records prove that these Heil scrapers are averaging 9% yds. pay load, per trip. The job is way ahead of schedule and the General Contractor, Harry T. Campbell Sons Co. and the Superintendent Jack Logan are well satisfied with Heil Dig-N-Carry performance . . . Have you a job that can be handled faster, and at less cost with Heil Dig-N-Carry scrapers? Now is the time to investigate . . . Write or wire.

THE HEIL CO.

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BRANCH FACTORY: HILLSIDE, N. J.—BRANCHES AND DISTRIBUTORS EVERYWHERE

NOVO FULL STREAM LINE SELF PRIMER

Going to the Show
Look it over—Think it over



This little package of dynamic energy can throw more water than you would expect from two pumps its size.

This Novo 2-inch Self-Priming Centrifugal Pump has the remarkable capacity of 6000 GPH A.G.C. Rating.

Smooth to handle—well balanced, and light in weight—150 lbs. You can have it with or without the double protection handles and air wheel. It's the neatest little job you ever saw.

Drop in at Booth A-28 at the New Orleans Road Show, or mail the coupon and we will tell you about the constant duty seal, the roller bearing stream line power unit, the remarkable price, and you can see for yourself the compact, symmetrical design.

There is a full line of self-priming centrifugal pumps up to 90,000 GPH with every type of mounting available.

NOVO ENGINE COMPANY
218 Porter St., Lansing, Michigan

Please mail me without obligation full information on the Novo 2-inch Full Stream Line Pump.
Also on the larger sizes of Novo Pumps.
Name _____
Address _____

Bulletins and Pamphlets

For free distribution to contractors, engineers and officials. Write for the catalogs you need.

Shaper for Road Maintenance

930 The Gledhill road shaper for shaping and smoothing road surfaces, finishing and blading black-top, refinishing and maintaining roads and similar uses, which is operated behind a light truck or can be equipped to be horse drawn, is described and illustrated in literature which contractors and state and county highway engineers may secure direct from the Gledhill Road Machinery Co., Galion, Ohio.

Free Data on Asphalt Distributors

931 A new catalog No. 506, describing two new Etnyre distributors, Models FC and FX, may be secured by interested contractors, state and county highway officials from E. D. Etnyre & Co., 400 Jefferson St., Oregon, Ill., on request.

New Catalog on Big Tilting Mixers

932 Bulletin No. 160, a new 16-page catalog just off the press describing Smith 28-S, 56-S, 84-S and 112-S tilting mixers of the type which have been used on many of the huge concreting jobs such as Boulder, Norris, Tygart and other dams, may be secured by those interested direct from the T. L. Smith Co., 1125 32nd St., Milwaukee, Wis.

Asphalts and Road Oils

933 Detailed specifications for Socony asphalt road oils and the various types of asphalts for road construction and maintenance, including cut-back surfacing asphalt, Binder A for surface treatment, refined asphalt for sheet asphalt paving, Binders B and C for penetration work, asphalt emulsion for surface treatment, road and plant-mix, and cold-patch asphalt for all types of patching, may be secured free upon request from the Standard Oil of New York Div., Socony-Vacuum Oil Co., 26 Broadway, New York City.

New 2 to 8-Inch Centrifugals

934 The new 2 to 8-inch Marlow self-priming centrifugal pumps in a variety of sizes and styles to meet contractors' requirements, are described in Bulletin 15 which Marlow Pumps, Ridgewood, N.J., will be glad to send on request.

More Yardage of Dirt Moved a Day

935 Because of the exclusive power-arm arrangement of lever and block-and-tackle on the Williams Champion clamshell bucket, the manufacturer claims that these buckets can handle more yardage per day. Complete details will be found in literature which may be secured direct from the Wellman Engineering Co., 7012 Central Ave., Cleveland, Ohio.

Non-Extruding Expansion Joints

936 Servicised Products Corp., 6051 West 65th St., Chicago, Ill., will be glad to send to interested contractors and engineers complete information on its new line of non-extruding expansion joints of various types which will be exhibited at the Road Show this month.

Hoists for Construction Jobs

937 Novo hoists, in a variety of sizes to meet the many requirements for hoists on construction jobs, such as material elevators, concrete masts, pile driving, dragline work etc., are described in literature which may be secured free from the Novo Engine Co., 216 Porter St., Lansing, Mich.

Diesel Tractors for Tough Jobs

938 Literature describing Caterpillar diesel tractors and the many tough jobs where they have gone into action may be secured by interested contractors and engineers from the Caterpillar Tractor Co., Peoria, Ill.

Pneumatic-Tired Wheelbarrows

939 Complete information on Lansing pneumatic-tired wheelbarrows, features of which are more room for knee action, handles adjusted for speedy pick-up, and noiseless running, may be secured by writing direct to the Lansing Co., Lansing, Mich., and mentioning this magazine.

Cutting Dirt-Moving Costs

940 Sauerman slackline or drag scrapers, which are designed for economical excavation to a depth of several hundred feet, and dirt moving up to 1,500 feet, are described in a catalog which Sauerman Bros., 464 So. Clinton St., Chicago, Ill., will be glad to send on request.

PARSONS TRENCHERS

PARSONS TRENCHERS are outstanding for their rugged construction, wide range of digging, adaptability to the greatest variety of soil conditions, compactness of design and ease of handling—both when actually on the job and when moving on the road.

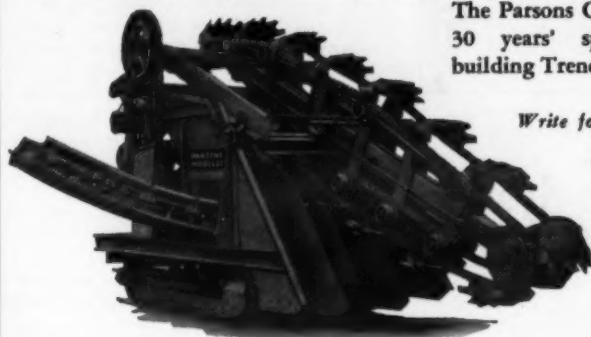
We cover every requirement with a wide range of sizes and styles.

The Parsons Company has had 30 years' specialization in building Trenching Machinery.

Write for full particulars.

THE PARSONS COMPANY
NEWTON, IOWA

Mention
Contractors and
Engineers Monthly



Servicised

EXPANSION JOINTS FOR HIGHWAY CONSTRUCTION

Be sure to specify Serv-
icised Quality Prod-
ucts for your highway
expansion joints. Long
and satisfactory service has proved them to
be correct in design and material.

See Our New Line
of Non-Extruding
Joints at the Road
Show

Bituminous Air Cell

Bituminous Air Cell
with Dowell Support

Rubber Air Cell

Interlocking Cork

Rubber Joint

Metal Shield
Asphalt Joint

Visit our booth at the Road
Show, New Orleans, week
of Jan. 12, Booth No. C-32.

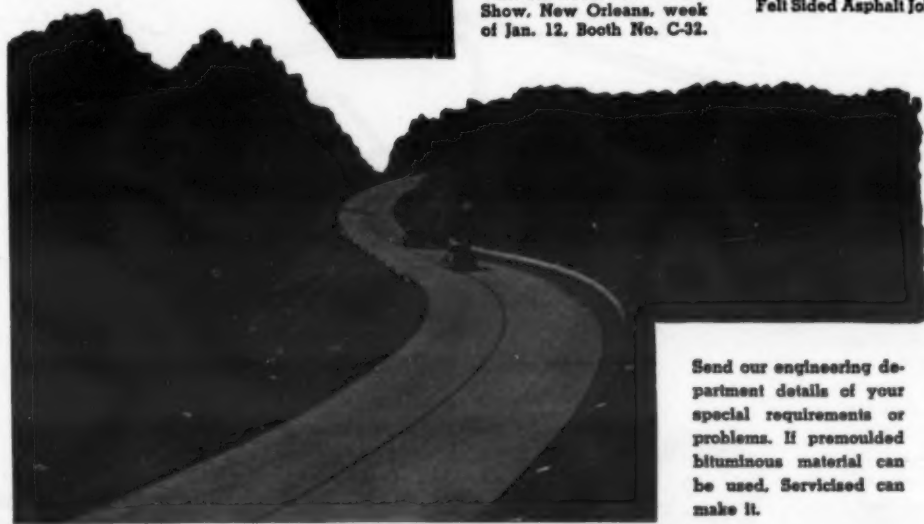
Sponge Rubber Joint

Type B Asphalt Joint

Cork Rubber Joint

Felt Sided Asphalt Joint

Fiber Joint



Send our engineering de-
partment details of your
special requirements or
problems. If premoulded
bituminous material can
be used, Servicised can
make it.

SERVICISED PRODUCTS CORP., 6043 W. 65th St., Chicago, Ill.

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470 FOURTH AVE., NEW YORK

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literature, without cost or obligation
(Indicate by numbers)

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Firm _____

Street _____

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P.S. Also send me catalogs and
prices on—

Bulletins and Pamphlets

(Continued from preceding page)

Catalog on New Motor Grader

941 The new Adams No. 20 motor grader, powered by an International I-12 tractor with 22½-hp engine, and designed for the lighter type of work such as maintaining county and township roads and similar jobs, is described and illustrated in a new catalog which interested contractors, state and county highway officials may secure free upon written request to J. D. Adams Co., Indianapolis, Ind.

Air-Operated Concrete Vibrators

942 Munsell air-operated vibrators for all classes of concrete construction, including bridge deck slabs, dams and locks, and portable vibrating screed boards for highway pavements are described in circulars which Munsell Concrete Vibrators, 997 West Side Ave., Jersey City, N.J., will be glad to send on request.

Solving the Drainage Problem

943 Facts about the savings in highway construction and maintenance costs claimed to be effected by the use of Gohi corrugated pipe culvert for drainage may be secured by interested contractors and engineers from Gohi Culvert Manufacturers, Inc., Newport, Ky.

Lubricants for Construction Equipment

944 Booklet R-W148, describing Dixon graphite lubricants for construction equipment, including cup and pressure gun graphited greases and waterproof graphited greases, which are insoluble in water and resistant to weather conditions, may be secured direct from the Joseph Dixon Crucible Co., Jersey City, N.J.

Semi-Circular Snow Plows

945 Information on Heil Hi-Speed Semi-Circle snow plows, which are designed for safe, fast, efficient snow plowing service, may be secured by interested state and county highway engineers direct from the Heil Co., 3000 W. Montana St., Milwaukee, Wis.

Truck Shovel for Emergency Road Work

946 The Michigan truck shovel, which is described in Bulletin C of the Michigan Power Shovel Co., Benton Harbor, Mich., offers high-speed low-cost shovel operation for a variety of jobs and has been found by many state and county highway engineers of particular service during bad weather for emergency highway work.

Catalog on Road Rollers

947 Buffalo-Springfield road rollers in a variety of sizes for construction and maintenance work are described in literature which interested contractors, state and county highway engineers may secure without obligation from the Buffalo-Springfield Roller Co., Springfield, Ohio.

New Roller Bearing Crushers

948 The new Cedar Rapids roller bearing crushers with sealed-in SKF bearings requiring no field lubrication, with jaw openings of 10 x 20 inches, 10 x 24 inches, 15 x 24 inches and 10 x 36 inches, are described in detail in Bulletin A-2 which the Iowa Mfg. Co., Cedar Rapids, Iowa, will be glad to send on request.

A Full Revolving ¾-Yard Shovel

949 Complete information on the Bay City 20, a full-revolving full ¾-yard shovel or 4-ton crane, a number of which have recently been purchased by the New York State Department of Public Works and the New Zealand Public Works Department, may be secured direct from Bay City Shovels, Inc., Bay City, Mich.

Autobiography of a Blasting Cap

950 Hercules Powder Co., Wilmington, Del., has issued a very readable booklet on Hercules electric blasting caps in the form of an autobiography of one of these necessary utilitarian adjuncts of successful blasting operations. The booklet is produced in two colors with a lacquered cover and will be sent to any readers of CONTRACTORS AND ENGINEERS MONTHLY who write for it and mention this magazine.



VIBRATING SCREED BOARD—LATEST TYPE

The Munsell Vibrating Screed Board mounted in a carrier frame is the latest development of the use of vibration for compacting concrete pavement where specifications require the application of vibration entirely free from the forms. The screed board is allowed to move vertically, freely; and, if so desired, will place the concrete in two or more courses.

Other types of Munsell Concrete Vibrators include: air-operated vibrators for all classes of concrete construction, portable vibrating screed boards, and special steam-operated vibrators for placing hot asphalt mixtures.

Illustrated and described in separate circulars. Write for circulars and engineering data.

MUNSELL CONCRETE VIBRATORS

997 WEST SIDE AVENUE

JERSEY CITY, N. J.

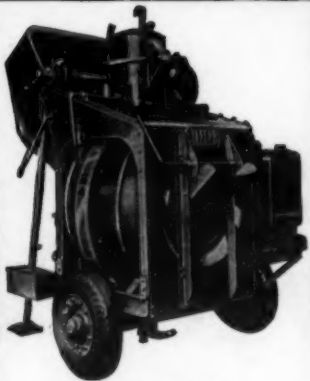
Announcing the New 1937 CHEVROLET TRUCKS and Commercial Cars



with new
HIGH-COMPRESSION
VALVE-IN-HEAD ENGINE

Giving even greater
performance—even
greater economy!

BUYING A MIXER?



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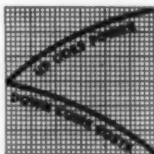
- Faster Charging and Discharge Speeds,
- Machined Steel Tracks,
- 2 Wheel Mounting with Timbers and Pneumatics,
- End Discharge Advantages,
- Man-Ten Alloy Steel,

Send for New Catalog, Prices
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JAEGER

"MORE POWER per gallon LOWER COST per load!"



For 1937, Chevrolet presents a new series of commercial cars and 1½-ton trucks which are even greater in all respects than the famous Chevrolet units which won such overwhelming preference during the past year.

New and improved High-Compression Valve-in-Head Engines assure maximum power from every gallon of gasoline, and are absolutely unequalled for all-round economy of operation and upkeep. Increased Load Space and Improved Load Distribution allow bigger payloads—more trips per day. Perfected Hydraulic Brakes supply the highest degree of safe, smooth stopping power. A new All-Steel Cab provides utmost safety and comfort for the driver. New Steelstream Styling makes them the smartest carriers on the road today. And, best of all, every part and feature of these new Chevrolet trucks is made strong and durable—built the Chevrolet way—to give many extra thousands of miles of dependable, economical transportation.

See your nearest Chevrolet dealer now and buy Chevrolet trucks or commercial cars for more power per gallon and lower cost per load.

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General Motors Installment Plan—monthly payments to suit your purse.



PERFECTED HYDRAULIC BRAKES

(with Double-Articulated Brake Shoe Linkage)
The smoothest, most efficient, and most
dependable brakes ever built.



MORE LOAD SPACE— IMPROVED LOAD DISTRIBUTION

Bigger loads per trip—more trips per day—
higher earnings per truck.



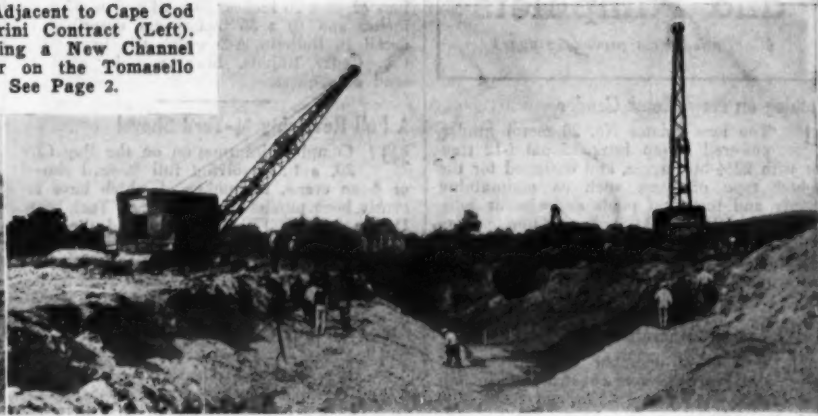
NEW STEELSTREAM STYLING

Making Chevrolet trucks for 1937
"the best-looking trucks on the road."

Contractors and Engineers Monthly



Dry Excavation Adjacent to Cape Cod Canal on the Perini Contract (Left). Digging and Lining a New Channel for Scusset River on the Tomasello Contract. See Page 2.



C. & E. M. Photos



C. & E. M. Photo

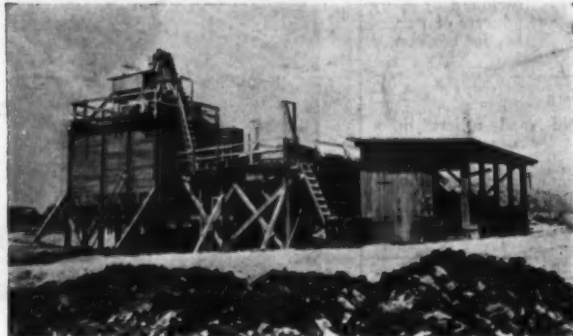
Washing a Mountain into a Valley and Swapping Rights-of-Way Will Produce a Better Coast-to-Valley Road Through Weaver-ville in Northern California. See Page 9.



Douglas County's New Distributor Played an Important Part in Eliminating Both Dust and Frost Boils from the Roads of This Eastern Nebraska County. William Green, County Highway Commissioner, Tells About His Construction and Maintenance Program And Its Cost on Page 2.



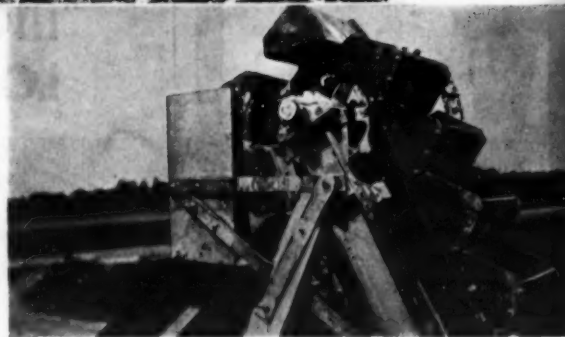
Breaks Like This Are Patched With Burlap in Arizona. See Page 1.



C. & E. M. Photos

Radcliff & Berry Erected This Well-Designed Crushing and Screening Plant To Supply Stone For a Road-Mix Contract Near Hanover, Ind. See Page 5.

Carefully Picked Units Erected in Sturdy Frames Made the Plant More Than Equal to All Demands Made Upon It. Top of Bucket Conveyor Is Shown At the Right.



Burlap for Waterproofing, Laid Out Before Spreading the Pre-Mixed Oil Mat, Shown Below.



C. & E. M. Photo

A Power Grader Turning Over a Windrow of the Oil-Mat Surface on the New 17.5-Mile Cut-Off Due West of Albuquerque. See Page 10.